JOHANN van der MERWE (Pty) Ltd
CONSULTING APPLIED EARTH AND ENVIRONMENTAL SCIENTISTS

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PROJECT No: M18/3762 **12th December 2018**

SIVEST CONSULTING ENGINEERS
P. O. Box 2921
RIVONIA 2128

Attention: Mr. Handre van Niekerk

Dear Sir

FACTUAL REPORT ON GEOTECHNICAL AND DOLOMITE STABILITY INVESTIGATION CARRIED OUT FOR: *PROPOSED ADDITIONS TO KAALFONTEIN HATCHERY ON: REMAINDER OF PORTION 7 OF THE FARM HARTEBEESTFONTEIN 17-IR, EKHURHULENI METROPOLITAN MUNICIPALITY, GAUTENG PROVINCE*

1. INTRODUCTION

This report, which supersedes our preliminary report dated 13th November 2018, covers the findings of a detailed geotechnical investigation that was carried out at the request of Mr. Handre van Niekerk of Sivest Consulting Engineers who is acting on behalf of his client, Astral Operations Limited. The purpose of the investigation was to determine the foundation and dolomite stability conditions underlying the site for proposed additions to the Kaalfontein Hatchery that is located due north of Kempton Park.

Twelve test pits were excavated across the site using a JCB 3CX backactor supplied by Richard Irons Plant Rentals from Midrand. The pits were entered and profiled by the undersigned, a registered professional engineering geologist in terms of the methods advocated by Jennings *et al* (1973). Disturbed and undisturbed soil samples were taken during the investigation and submitted to Roadlab's commercial soils laboratory in Primrose for testing and identification. Based on the requirements of SANS 1936, five percussion boreholes were drilled underneath the footprint of the various proposed new structures.

The location of exploratory holes is shown on the attached "Site Plan", Drawing Number M18/3765 at the back of the report. Copies of the soil profile and percussion borehole descriptions and the results of the soil tests are attached at the back of the report. Reference was made to the geological map 2628 East Rand to a scale of 1: 250 000, to a colour aerial photograph obtained from Google Earth. A site development plan concept, drawing number 5000-01, prepared to a scale of 1: 500 by Sivest showing existing and proposed structures was provided.

2. SITE SOILS AND GEOLOGY

The site for the extensions to Kaalfontein Hatchery is underlain by transported silty and gravelly soils overlying residual soils and dolomite bedrock belonging to the Chuniespoort Group, Transvaal Supergroup. Chert-rich dolomite was encountered in the boreholes and it can therefore be assumed that the site is located in the Monte Christo Formation of the Chuniespoort Group.

The southern and part of the extreme northern part of the study area is blanketed by a thin veneer of dark brown, *medium dense* clayey sand overlying *dense* to *very dense* chert rubble and in places, soft rock chert bedrock. The central and northern portions of the site is blanketed by a prominent horizon of dark red, *firm* to *stiff*, sandy silt extending from 0,9m to >3,3m below surface as shown the "Site Plan", this horizon is underlain by coarse dolomite residuum at depth.

Gradual to abrupt refusal of the JCB 3CX backactor was encountered in either chert bedrock or in very dense chert residuum at depths ranging from below 0,9m in an isolated pit to about 2,4m below surface in four other pits, elsewhere, no refusal was experienced down to at least 3,0m below surface. The water table, whether perched or permanent, was not encountered in the test pits during the investigation which was carried out towards the end of the dry season.

3. STABILITY CONSIDERATIONS

3.1 Drilling Results and Dolomite Stability

A summary of the drilling results obtained from the driller's logs and logging of the boreholes appear in Table 3.1 below.

Table: 3.1: Summary of drilling results

BH NO	POROUS ZONES	<10s/m	AIR/ SAMPLE LOSS	WATER STRIKE (m)	WATER REST LEVEL	DOLOMITE DEPTH (m)	BOREHOLE DEPTH (m)
KHB/1	7m – 10m	7m – 8m	Below 14m	None	18,6m	19m	25m
KHB/2	None	None	None	None	18,2m	17m	25m
KHB/3	None	None	26m – 33m	None	Dry	24m	33m
KHB/4	None	11m – 12m	None	17m	16,8m	21m	27m
KHB/5	7m – 15m	13m – 14m	None	12m	15,2m	16m	23m

Table 3.2: Evaluation of conditions

BH NO	GENERAL CONDITIONS AND NATURE OF MATERIALS	RECEPTACLE DEVELOP-MENT	MOBILISING POTENTIAL	POTENTIAL DEVELOP-MENT SPACE	RISK (nds)	TENTATIVE INHERENT HAZARD CLASS
KHB/1	Coarse CHERT RUBBLE to 1m over grey and yellow, sandy SILT with CHERT BANDS to 7m over *soft*, CLAY-WAD to 10m over *hard rock* DOLOMITE to 14m presumably over CHERT BANDS in WAD matrix to 19m over *hard rock* DOLOMITE to 30m+. Water table at 18,6m.	Medium	Medium	Medium	Medium	IHC4
KHB/2	Coarse CHERT RUBBLE to 6m over *stiff*, CLAY-WAD with CHERT BANDS to 17m over *hard rock* DOLOMITE to 25m+. Water table standing at 18,2m.	Medium	Medium	Medium	Medium	IHC 4
KHB/3	Coarse CHERT RUBBLE to 1m over dark red, sandy SILT with CHERT BANDS to 4m over soft rock CHERT to 6m over *very stiff*, CLAY-WAD to 9m over soft rock to *hard rock* CHERT to 24m over *hard rock* DOLOMITE. Hole dry.	Medium	Medium	Medium	Medium	IHC 4
KHB/4	Coarse CHERT RUBBLE to 4m over *stiff*, CLAY-WAD with CHERT BANDS to 14m over *soft rock* DOLOMITE to 18m over CLAY-WAD with CHERT & SHALE BANDS to 21m over *hard rock* DOLOMITE to 27m+. Water table standing at 16,8m.	Medium	Medium	Medium	Medium	IHC 4
KHB/5	Dark red, dense gravelly CLAY to 4m over dark brown, sandy CLAY with CHERT BANDS to 7m over stiff, CLAY-WAD with CHERT BANDS to 16m over *hard rock* DOLOMITE to 23m+. Water table standing at 15,2m.	Medium	Medium	Medium	Medium	IHC 4

Note: * = SANS 1936-1 document: Development of dolomitic land – Part 1: General principles and requirements.

The boreholes drilled at the site for the proposed additions to Kaalfontein Hatchery, showed generally fair to moderate conditions with the boreholes exhibiting Inherent Hazard Class 4 (IHC 4) conditions. Based on the results of the drilling exercise, the site can be generally classified as having an Inherent Hazard Class 4 dolomitic classification due to the fact that the site is underlain by chert rubble overlying stiff, clay-wad with a low mobilization potential and the area is considered to be non-dewatered. The conclusions are based on the SANS1936 (2012 document and the Council for Geoscience Consultants Guide: Approach to sites on dolomite land (2007).

The water table of the site and its surroundings is deemed to be less than 20m below surface, based on the present drilling results. Ground water information obtained from the Department of Water Affairs have shown the site to be in the Sterkfontein East Compartment with the regional water table at around 1 475m above sea level which corresponds to the water table on site which is at about 1 572m , no dewatering is assumed to take place in the vicinity of the study area.

The site is deemed to be a type C5 type development according to SANS 1936 Table 2 with a commercial type usage where processing and the storage of liquids, packaging and warehousing will take place and a dolomite "D" designation of D3 has been assigned to this site. Based on the specifications of the document SANS 1936-2: Development of Dolomite Land- Part 2 and on the scenario supposition of Buttrtick et al (2001), the investigation has shown the property to be characterized as having an Inherent Hazard Classification of IHC4//4 which implies that there is a medium risk for small to large sinkholes and a low risk for very large sinkhole formation in a non-dewatering scenario.

4. GEOTECHNICAL CONSIDERATIONS

4.1 Expansive Soils

The site soils are generally silty, sandy and gravelly and are considered to be potentially "low" in the degree of expansiveness based on tests carried out on similar materials and according to the The Van der Merwe (1964) method. A total surface heave value of less than 7mm is predicted across the site, should the moisture condition of the soils change from a dry to a saturated state.

4.2 Compressible and Collapsible Soils

Two undisturbed soil samples, representative of the dark red colluvial colluvial soils that blanket the central and northern portions of the site were tested to determine the collapse potential of the material according to the method advocated by Jennings (1974). A summary of the results of the laboratory tests appears below in Table 4.1.

TABLE 4.1: COLLAPSE POTENTIAL TEST RESULTS

HOLE NUMBER	DEPTH (m)	DRY DENSITY (kg/m³)	COLLAPSE POTENTIAL (%)	COMPRESSI-BILITY (%)	TROUBLE RATING
KH/1	1,00	1 428	19,40	2,09	Severe Trouble
KH/12	0,80	1 538	14,40	2,86	Severe Trouble

An analysis of the above results indicates that the colluvial soils which blanket the site central and northern portions are potentially moderately to highly collapsible and compressible with a collapse rating of "severe trouble" in terms of collapse settlement, according to Jennings.

The blanketing horizons across the southern and extreme northern portions of the site consists of sandy colluvium over coarse chert residuum with an overall consistency of loose to dense for the upper 1,0m materials. These horizons are considered to be potentially compressible should it be subject to an imposed load after being saturated, however, these soils were too friable in order to take undisturbed soil samples.

4.3 Ground Water and Soil Chemistry

Although no ground water seepages were encountered in the test pits during the investigation, the necessary damp proofing precautions should be taken underneath structures. The site soils are expected to be potentially chemically aggressive with regards to underground ferrous metal pipes and the use of non-ferrous metal pipes or plastic pipes are recommended for wet services, the foundation soils should be treated with an environmentally friendly insecticide to combat termites.

4.4 Excavation Characteristics

No problems should be experienced in order to remove the blanketing site soils across the major portion of the site down to a depth of at least 2,5m and even 3,0m below surface using conventional earth-moving machines. An isolated area in the *southern portion* of the site (test pit KH/7) will require very hard excavation using a more powerful machine and possibly the use of jackhammers for removal from below 0,9m. Sidewalls of deep excavations can be expected to be reasonably stable during construction in the dry season whereas isolated areas of unstable conditions may occur in the very loose chert residuum.

4.5 Earthworks

The upper site soils were tested to determine their compaction characteristics. A summary of the test results appears below in Table 4.2: -

TABLE 4.2: SUMMARY OF COMPACTION TESTS

HOLE NO	DEPTH (m)	SOIL TYPE	PI	GM	CBR	TRH14	SWELL (%)
KH/1	0,1 – 3,0	Sandy SILT	9	0,98	7	G10	0,72
KH/2	0,0 – 2,1	Sandy GRAVELS	15	1,69	19	G8	0,24
KH/3	0,0 – 1,3	Gravelly SILT	12	1,85	13	G8	0,24

Note : PI = Plasticity Index
GM = Grading Modulus
CBR = California Bearing Ration at 95% Mod AASHTO compaction

Based on the results of the compaction tests, it is evident that the dark red sandy silt that blankets the *central and northern portions* of the site is only marginally suitable for use in construction of roads or paved areas being only G10 quality material. The colluvial and residual coarse chert horizons that covers the remainder of the site should be suitable for use as backfill underneath surface beds and for use in the construction of selected layers in road and pavement construction (G8 quality) after carefully removing all organic material. Cognizance should be taken in the design and construction of roads and paved areas of the potentially compressible nature of the upper soil horizons.

4.6 Foundations

According to Table 2 of SANS 1936-1:2012: "Permissible land usage as per inherent hazard class" the site classifies as a C5 type development and a dolomite designation of D3 has been assigned to the property. Possible foundation solutions should adhere to SANS 10400-H requirements and may include the use of reinforced concrete slab-on-ground foundations which in turn are founded onto engineered fill mattresses comprising chert gravel or other granular fill; concrete raft foundations; piled foundations or other appropriate solutions. All foundations should be suitably designed to span at least 5m loss of support, should it occur.

The necessary drainage precautions, applicable to dolomite terrain should be adhered to and a risk management system should be put in place. In addition to the drainage precautionary measures, a risk management policy should be adopted. These measures are designed to ensure the long-term stability of the site and to ensure a continuous assessment of the overall stability of the site in terms of the new development. Stringent drainage precautionary measures should be employed, a wet services audit of the area should be carried out and a dolomite risk management strategy should be put in place for the new development.

5. GENERAL

The above observations and recommendations are based on the project as described with the assumption that geological conditions will not vary drastically from those encountered during the investigation. It is recommended that the excavation for foundations be inspected by a competent person during construction in order to verify that the materials thus exposed are not at variance with those described in the report.

The placement of the fill must be controlled with suitable field tests to confirm that the required densities are achieved during compaction and that the quality of fill material is within specification.

It should be pointed out that the investigation was carried out using present day and the latest state-of-the-art techniques. Certain assumptions and extrapolations have had to be made and consequently, conditions at variance to those described may occur. The investigator cannot be held responsible if some poor zones for development have not been identified during the investigation and the client/developer/local city council/home owner etc. must be aware of these risks when developing in a dolomitic terrain.

Yours faithfully

JOHANN VAN DER MERWE (Pr. Sci. Nat.)
Engineering Geologist

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5. APPENDICES

Appendix 1: Percussion Borehole Logs and driller's logs

Appendix 2: Test Pit Profiles

Appendix 3: Laboratory Test Results

Appendix 4: Suggested Drainage Precautions (Buttrick 1992)

Appendix 5: Risk Management Policy

Site Plan

Adapted from Sevist Project Number14992, Drawing Number 5000-01, Revision C, created 1 November 2018.

N

Y 71200 Y 71100

X 2879900 X 2880000 X 2880100

1570m 1569m 1568m 1567m 1566m 1571m 1572m 1573m 1565m

KH/1
KH/2 (2,1)
KH/3
KH/4
KH/5
KH/6 (2,4)
KH/7 (0,9)
KH/8 (2,4)
KH/9
KH/10 (2,5)
KH/11 (2,6)
KH/12

KHB/1
KHB/2
KHB/3
KHB/4
KHB/5

BM01 1572.820
BM02 1566.455
BM03 1567.191
BM04 1571.129

EXISTING STAFF BUILDINGS
EXISTING MANAGERS BUILDING
EXISTING MANAGERS BUILDING
EXISTING HATCHERY FOOTPRINT
ABLUTION EXTENSION
BOARDROOM
RECEPTION
EXISTING BOILER
BOILERS AND COAL YARD (EXTENT TBC)
EXISTING ±100kl SEWER HOLDING SUMP / PUMP STATION
EXISTING ±200kl SEWER PUMP STATION
NEW 200kl SEWER PUMP STATION
NEW CIRCULAR ZINCALUME STEEL RESERVOIR
SETTER BAY 1
SETTER BAY 2
SETTER BAY 3
HATCHERY ROOM 1
HATCHERY ROOM 2
HATCHERY ROOM 3
KITCHEN ROOM
NEW CONCRETE ROAD
NEW 60mm INTERLOCKING PAVED ACCESS ROAD
NEW 18 STRAND ELECTRIC FENCE
NEW 75mm HDPE RISING MAINS
CONNECT SEWER OUTFALL
EMH
TAP
FH
MS
SE
GI
FT

LEGEND:

KH/2 — TEST PIT BY BACKACTOR, POSITION AND NUMBER SHOWING

(2,1) — REFUSAL DEPTH IN M.B.G.L.

KHB/1 — PERCUSSION BOREHOLE, POSITION AND NUMBER

AREA COVERED BY PROMINENT HORIZON (0,9 TO >3,0) OF DARK RED SANDY SILT.
BOUNDARIES AND EXTENT OF AREA VERY APPROXIMATE

JOHANN VAN DER MERWE (PTY) LTD
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TITLE / TITLE SITE PLAN	TEK / DRG NO M18/3762
LIGGING / LOCALITY REMAINDER OF PORTION 7 HARTEBEESTFONTEIN 17-IR	DATUM / DATE NOVEMBER 2018
KLIËNT / CLIENT SIVEST CONSULTING ENGINEERS	SKAAL / SCALE 1 : 1000 ON A3

ROADLAB Laboratories
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Civil Engineering Materials Testing Laboratory
Established 2011

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Client: Johann Van der Merwe
Project: Kaalfontein Hatchery Vob 3742
Project No.:91454

Attention:

Dear Sir

Test Report : - CBR TEST RESULTS

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		19575			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		KH/1			
LAYER TESTED / SAMPLED FROM		0-300mm			
DATE SAMPLED		01/11/2018			
DATE RECEIVED		01/11/2018			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Dark Red			
GRADING ANALYSIS - % PASSING SIEVES (SANS 3001-GR1:2010;SANS 3001-GR2:2010)					
SIEVE ANALYSIS **(SANS GR1:2010)**	100,0	100			
	75,0	100			
	63,0	100			
	53,0	100			
	37,5	100			
	28,0	100			
	20,0	100			
	14,0	100			
	5,0	98			
	2,00	97			
	0,425	72			
	0,075	33			
ATTERBERG LIMITS ANALYSIS (SANS 3001-GR10:2010;SANS 3001-GR11:2010)					
ATTERBERG LIMITS **(SANSGR10;GR11)**	LL%	27			
	P.I.	9			
	LS%	7			
GM		0,98			
CLASSIFI - CATION	H.R.B.*	A-2-4			
	COLTO*	<G9			
	T.R.H. 14*	G10			
CALIFORNIA BEARING RATIO (SANS 3001-GR30:2010;SANS 3001-GR40:2010)					
MOD AASHTO **(SANS GR30)**	OMC%	10,2			
	MDD(KG/M^3)	1990			
C.B.R.	COMP MC	10,4			
	% SWELL	0,72			
C.B.R. **(SANS GR40)**	100%	9			
	98%	8			
	97%	7			
	95%	7			
	93%	6			
	90%	5			
MOD ITS : DRY (kPa) (GR54)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB	N/A			
	ON SITE	N/A			
TEST TYPE		IND / CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLING METHOD		**TMH5 - MB1**			
ENVIRONMENTAL CONDITION WHEN SAMPLED		None			
REMARKS & NOTES		None			

Kind Regards

Roadlab Centurion
Mr. W Cockcroft

Remarks :

The samples were subjected to analysis according to SANS Test Methods
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab (Pty) Ltd
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Compiled By : Leandri Bianchina

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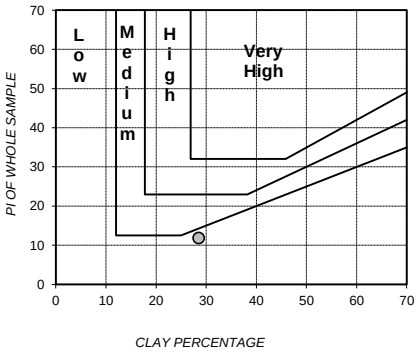
OUR REF : 91454
CLIENT : Johann Van der Merwe
PROJECT : Kaalfontein Hatchery

DATE RECEIVED : 29/10/2018
POSITION : KH/1
LAYER : 1000mm
SAMPLE No. : 19661
SAMPLE DESCRIPTION : Dark Red Brown Silty Clayey Sand

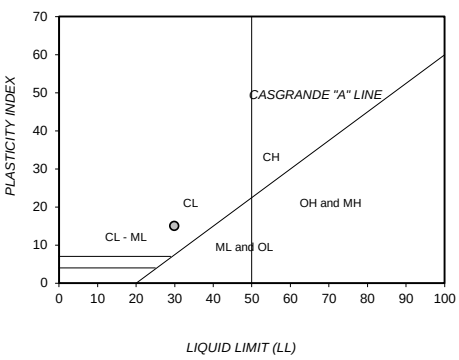
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**11,8**
Sieve analysis Cumulative percentage passing (mm)	100,0	100
	75,0	100
	63,0	100
	50,0	100
	37,5	100
	28,0	100
	20,0	100
	14,0	100
	5,00	100
	2,000	95
	0,425	79
	0,250	71
	0,150	62
	0,075	55
	50 µm	38
	5 µm	34
	2 µm	28,5
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	17
	0.425 - 0.250	8
	0.250 - 0.150	9
	0.150 - 0.075	7
	< 0.075	58
Effective size		0,056
Uniformity Coefficient		32,7
Curvature Coefficient		1,1
Oversize Index		0,0
Shrinkage Product		631,2
Grading Coefficient		4,8
Grading modulus		0,71
Atter-berg Limits	Liquid Limit	30
	Plasticity Index	15
	Linear Shrinkage	8,0
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-6 (5)

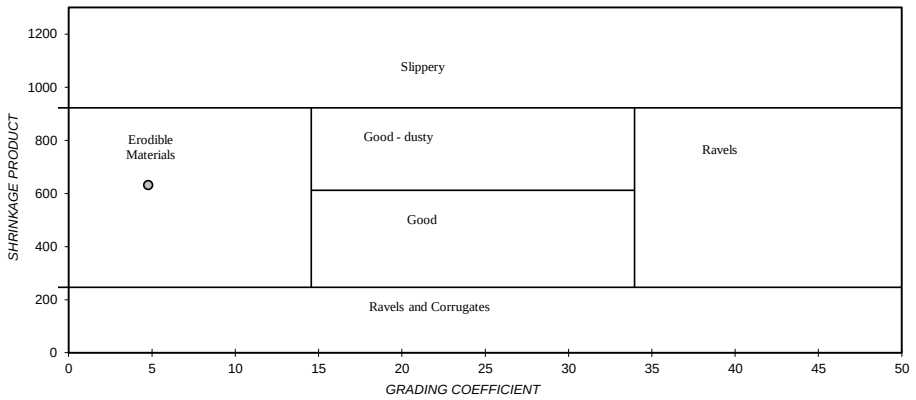
POTENTIAL EXPANSIVENES



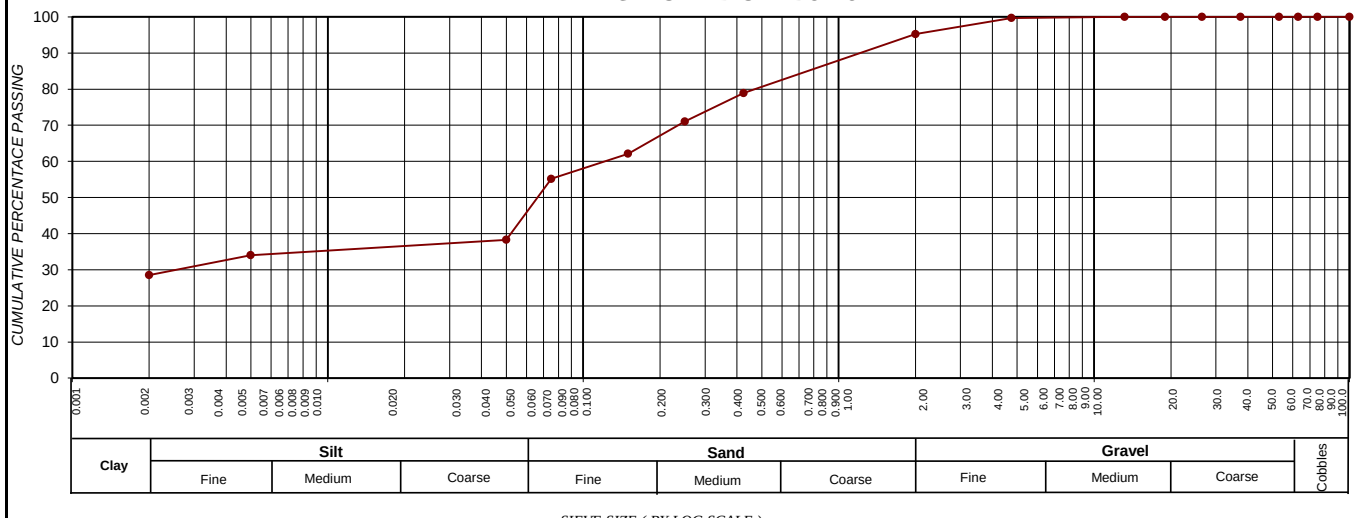
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
28,5	15,4	51,3	4,8

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The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		19576			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		KH/2			
LAYER TESTED / SAMPLED FROM		0-2100mm			
DATE SAMPLED		01/11/2018			
DATE RECEIVED		01/11/2018			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Dark Red Brown			
GRADING ANALYSIS - % PASSING SIEVES (SANS 3001-GR1:2010;SANS 3001-GR2:2010)					
SIEVE ANALYSIS **(SANS GR1:2010)**	100,0	100			
	75,0	100			
	63,0	100			
	53,0	100			
	37,5	100			
	28,0	100			
	20,0	100			
	14,0	100			
	5,0	85			
	2,00	62			
	0,425	39			
	0,075	30			
ATTERBERG LIMITS ANALYSIS (SANS 3001-GR10:2010;SANS 3001-GR11:2010)					
ATTERBERG LIMITS **(SANSGR10;GR11)**	LL%	46			
	P.I.	15			
	LS%	11			
GM		1,69			
CLASSIFI - CATION	H.R.B.*	A-2-7			
	COLTO*	G8			
	T.R.H. 14*	G8			
CALIFORNIA BEARING RATIO (SANS 3001-GR30:2010;SANS 3001-GR40:2010)					
MOD AASHTO **(SANS GR30)**	OMC%	17,7			
	MDD(KG/M^3)	1864			
C.B.R.	COMP MC	17,8			
	% SWELL	0,24			
C.B.R. **(SANS GR40)**	100%	47			
	98%	33			
	97%	27			
	95%	19			
	93%	13			
	90%	8			
MOD ITS : DRY (kPa) (GR54)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB	N/A			
	ON SITE	N/A			
TEST TYPE		IND / CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLING METHOD		**TMH5 - MB2**			
ENVIRONMENTAL CONDITION WHEN SAMPLED		None			
REMARKS & NOTES		None			

Kind Regards

Roadlab Centurion
Mr. W Cockcroft

Remarks :

The samples were subjected to analysis according to SANS Test Methods
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Client: Johann Van der Merwe
Project: Kaalfontein Hatchery Vob 3742
Project No.:91454

Attention:

Dear Sir

Test Report : - CBR TEST RESULTS

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		19575			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		KH/3			
LAYER TESTED / SAMPLED FROM		0-1300mm			
DATE SAMPLED		01/11/2018			
DATE RECEIVED		01/11/2018			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Dark Red			
GRADING ANALYSIS - % PASSING SIEVES (SANS 3001-GR1:2010;SANS 3001-GR2:2010)					
SIEVE ANALYSIS **(SANS GR1:2010)**	100,0	100			
	75,0	100			
	63,0	100			
	53,0	98			
	37,5	83			
	28,0	79			
	20,0	74			
	14,0	71			
	5,0	60			
	2,00	53			
	0,425	37			
	0,075	25			
ATTERBERG LIMITS ANALYSIS (SANS 3001-GR10:2010;SANS 3001-GR11:2010)					
ATTERBERG LIMITS **(SANSGR10;GR11)**	LL%	33			
	P.I.	12			
	LS%	9			
GM		1,85			
CLASSIFI - CATION	H.R.B.*	A-2-6			
	COLTO*	G8			
	T.R.H. 14*	G8			
CALIFORNIA BEARING RATIO (SANS 3001-GR30:2010;SANS 3001-GR40:2010)					
MOD AASHTO **(SANS GR30)**	OMC%	15,2			
	MDD(KG/M^3)	1849			
C.B.R.	COMP MC	15,3			
	% SWELL	0,24			
C.B.R. **(SANS GR40)**	100%	28			
	98%	21			
	97%	18			
	95%	13			
	93%	10			
	90%	6			
MOD ITS : DRY (kPa) (GR54)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB	N/A			
	ON SITE	N/A			
TEST TYPE		IND / CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLING METHOD		**TMH5 - MB3**			
ENVIRONMENTAL CONDITION WHEN SAMPLED		None			
REMARKS & NOTES		None			

Kind Regards

Roadlab Centurion
Mr. W Cockcroft

Remarks :

The samples were subjected to analysis according to SANS Test Methods
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab (Pty) Ltd
Test reports may only be reproduced or published in their full context
Compiled By : Leandri Bianchina

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Civil Engineering Materials Testing Laboratory
Established 2011

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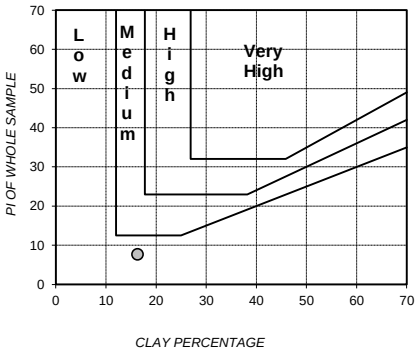
OUR REF : 91454
CLIENT : Johann Van der Merwe
PROJECT : Kaalfontein Hatchery

DATE RECEIVED : 29/10/2018
POSITION : KH/3
LAYER : 1300-3500mm
SAMPLE No. : 19578
SAMPLE DESCRIPTION : Dark Red Brown Clayey Sandy Gravel

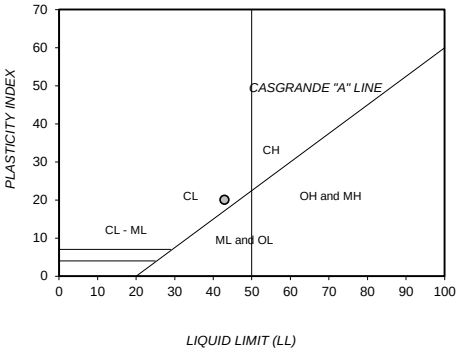
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**7,7**
Sieve analysis Cumulative percentage passing (mm)	100,0	100
	75,0	100
	63,0	100
	50,0	100
	37,5	92
	28,0	92
	20,0	87
	14,0	83
	5,00	68
	2,000	57
	0,425	38
	0,250	35
	0,150	31
	0,075	28
	50 µm	20
	5 µm	19
	2 µm	16,3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	32
	0.425 - 0.250	6
	0.250 - 0.150	7
	0.150 - 0.075	6
	< 0.075	49
Effective size		0,056
Uniformity Coefficient		32,7
Curvature Coefficient		1,1
Oversize Index		8,0
Shrinkage Product		345,6
Grading Coefficient		23,9
Grading modulus		1,77
Atter-berg Limits	Liquid Limit	43
	Plasticity Index	20
	Linear Shrinkage	9,0
	PI < 0.075	-
Unified Soil Classification		SC
U.S. Highway Classification		A-2-7 (1)

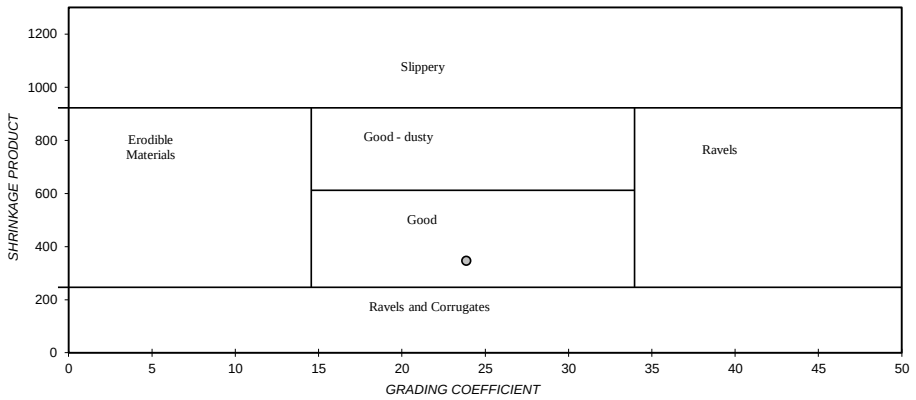
POTENTIAL EXPANSIVENES



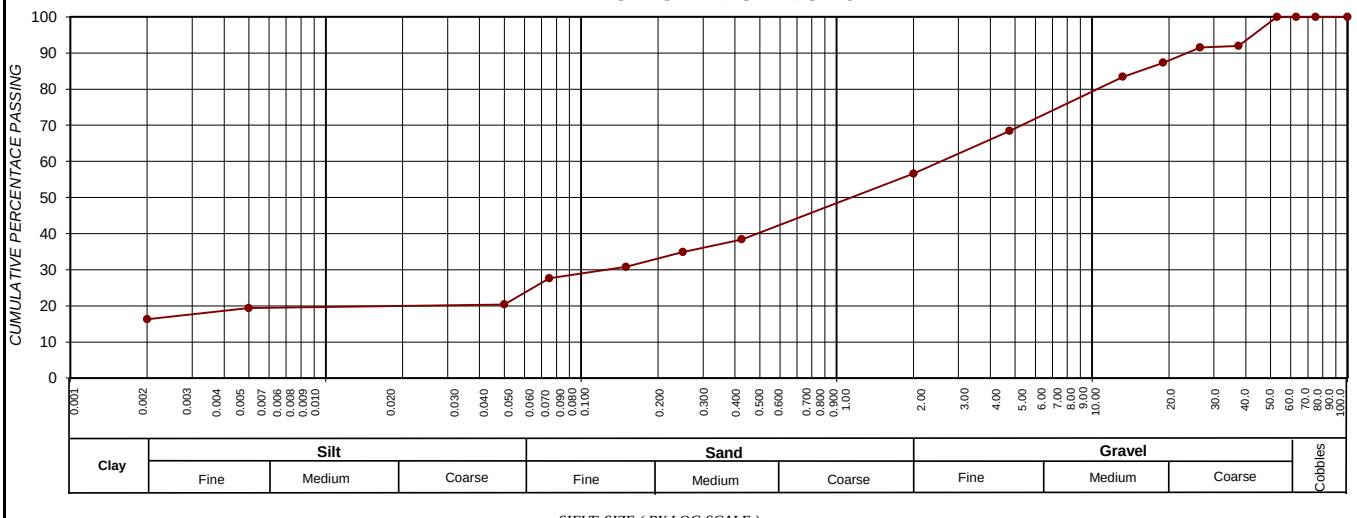
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
16,3	6,9	33,4	43,4

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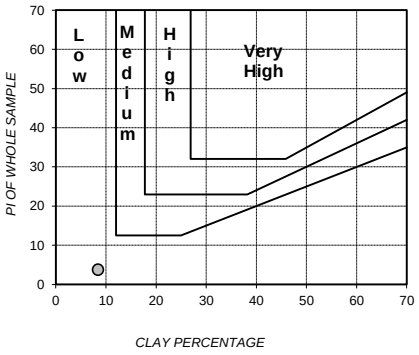
OUR REF : 91454
CLIENT : Johann Van der Merwe
PROJECT : Kaalfontein Hatchery

DATE RECEIVED : 29/10/2018
POSITION : KH/6
LAYER : 1000-2000mm
SAMPLE No. : 19580
SAMPLE DESCRIPTION : Dark Red Brown Sandy Gravel

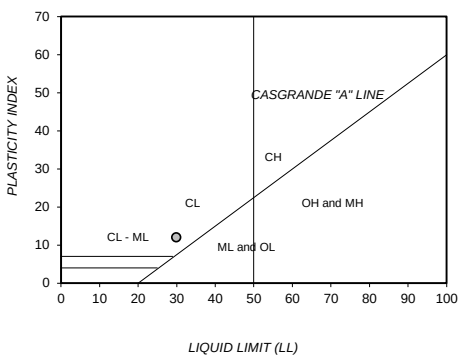
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**3,8**
Sieve analysis Cumulative percentage passing (mm)	100,0	100
	75,0	100
	63,0	100
	50,0	100
	37,5	95
	28,0	93
	20,0	88
	14,0	81
	5,00	59
	2,000	42
	0,425	32
	0,250	27
	0,150	22
	0,075	18
	50 µm	17
	5 µm	12
	2 µm	8,4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	25
	0.425 - 0.250	11
	0.250 - 0.150	11
	0.150 - 0.075	9
	< 0.075	44
Effective size		0,056
Uniformity Coefficient		32,7
Curvature Coefficient		1,1
Oversize Index		4,9
Shrinkage Product		252,0
Grading Coefficient		29,8
Grading modulus		2,09
Atter-berg Limits	Liquid Limit	30
	Plasticity Index	12
	Linear Shrinkage	8,0
	PI < 0.075	-
Unified Soil Classification		GC
U.S. Highway Classification		A-2-6 (0)

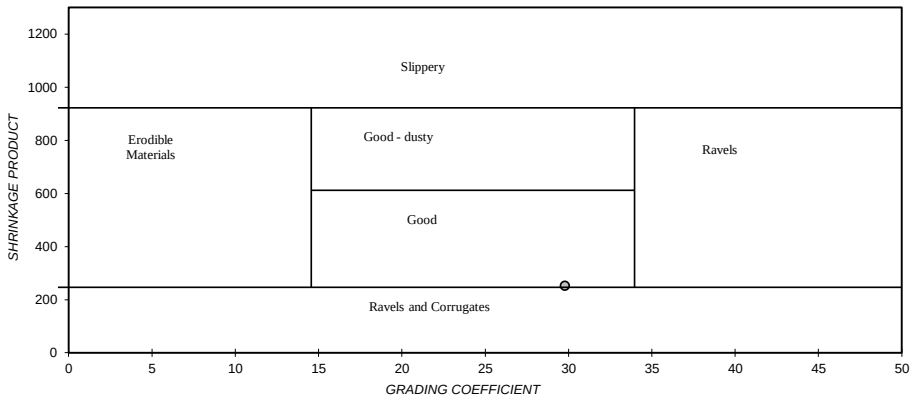
POTENTIAL EXPANSIVENES



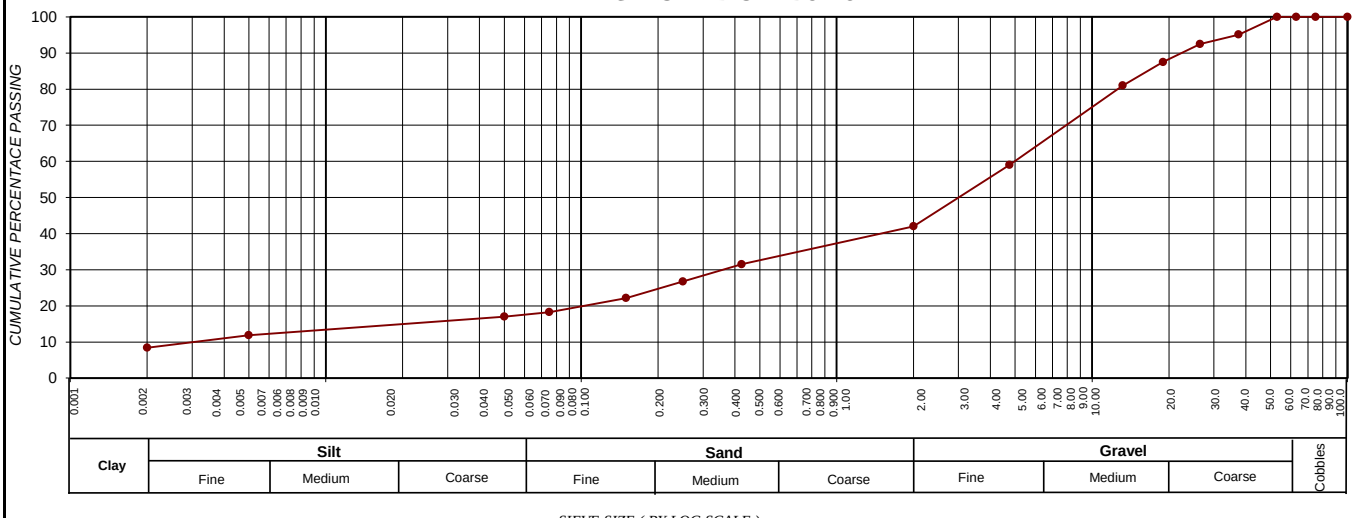
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
8,4	8,9	24,7	58,0

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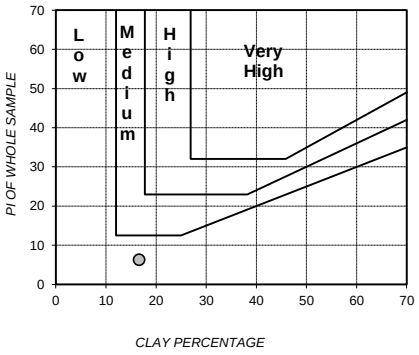
OUR REF : 91454
CLIENT : Johann Van der Merwe
PROJECT : Kaalfontein Hatchery

DATE RECEIVED : 29/10/2018
POSITION : KH/8
LAYER : 100-1200mm
SAMPLE No. : 19582
SAMPLE DESCRIPTION : Dark Red Brown Silty Clayey Sandy Gravel

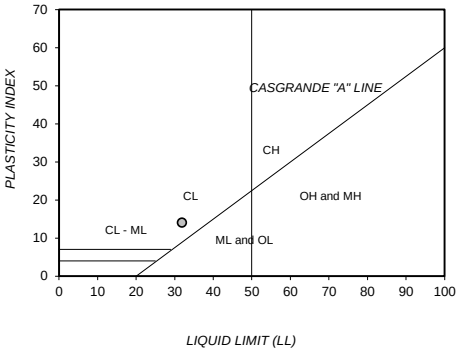
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**6,3**
Sieve analysis Cumulative percentage passing (mm)	100,0	100
	75,0	100
	63,0	100
	50,0	100
	37,5	100
	28,0	95
	20,0	88
	14,0	84
	5,00	71
	2,000	59
	0,425	45
	0,250	40
	0,150	35
	0,075	32
	50 µm	25
	5 µm	22
	2 µm	16,6
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	24
	0.425 - 0.250	9
	0.250 - 0.150	8
	0.150 - 0.075	6
	< 0.075	54
Effective size		0,056
Uniformity Coefficient		32,7
Curvature Coefficient		1,1
Oversize Index		0,0
Shrinkage Product		359,2
Grading Coefficient		25,2
Grading modulus		1,64
Atter-berg Limits	Liquid Limit	32
	Plasticity Index	14
	Linear Shrinkage	8,0
	PI < 0.075	-
Unified Soil Classification		SC
U.S. Highway Classification		A-2-6 (1)

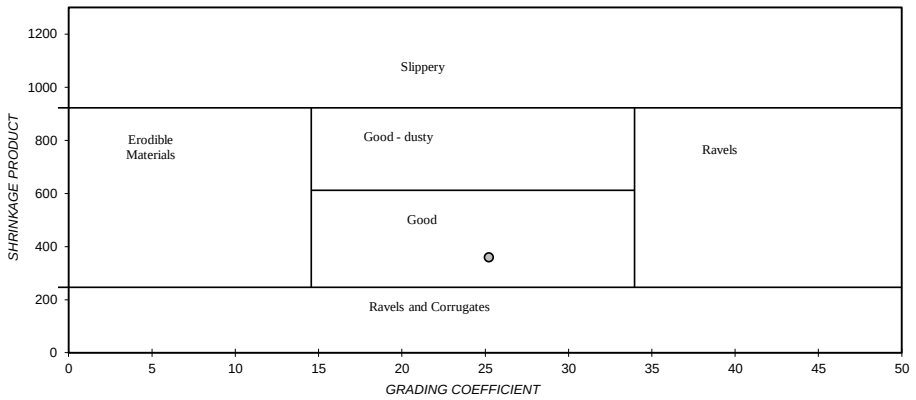
POTENTIAL EXPANSIVENES



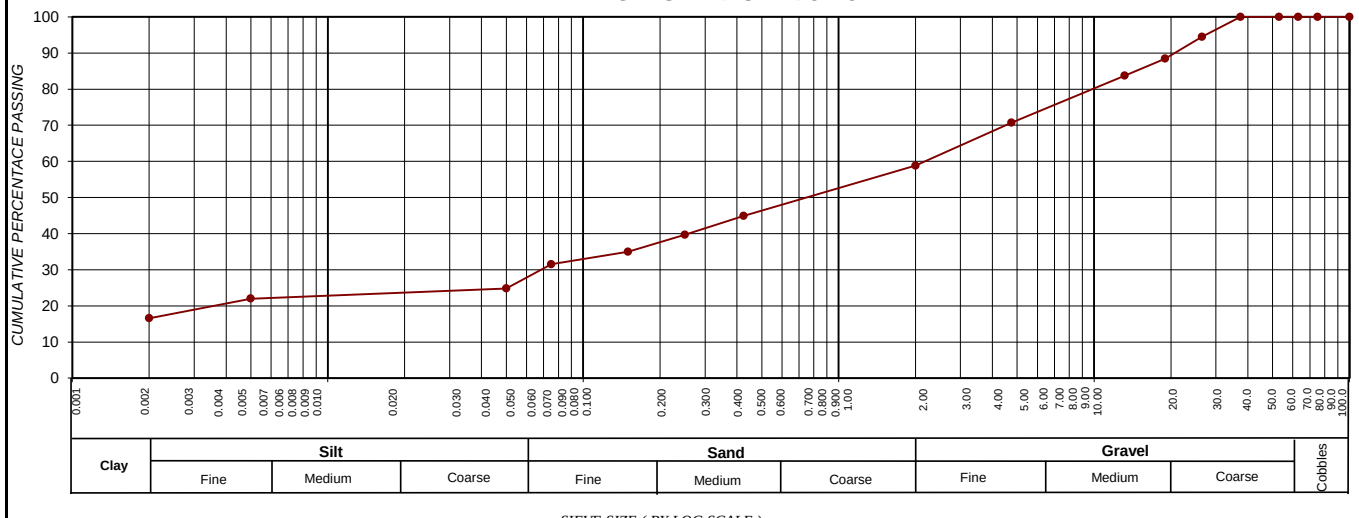
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
16,6	10,9	31,3	41,2

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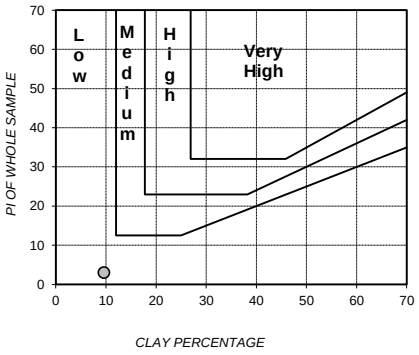
OUR REF : 91454
CLIENT : Johann Van der Merwe
PROJECT : Kaalfontein Hatchery

DATE RECEIVED : 29/10/2018
POSITION : KH/8
LAYER : 1200-2400mm
SAMPLE No. : 19488
SAMPLE DESCRIPTION : Dark Red Brown Silty Sandy Gravel

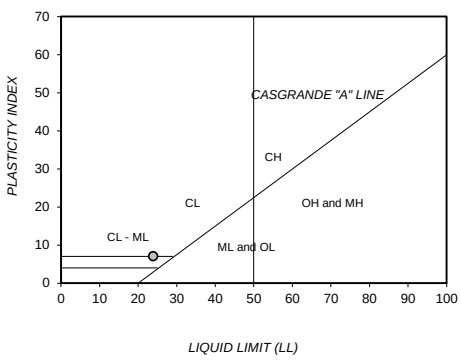
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**3,0**
Sieve analysis Cumulative percentage passing (mm)	100,0	100
	75,0	100
	63,0	100
	50,0	100
	37,5	100
	28,0	97
	20,0	91
	14,0	87
	5,00	71
	2,000	60
	0,425	43
	0,250	39
	0,150	34
	0,075	30
	50 µm	24
	5 µm	22
	2 µm	9,6
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	28
	0.425 - 0.250	8
	0.250 - 0.150	8
	0.150 - 0.075	7
	< 0.075	50
Effective size		0,056
Uniformity Coefficient		32,7
Curvature Coefficient		1,1
Oversize Index		0,0
Shrinkage Product		259,2
Grading Coefficient		26,4
Grading modulus		1,67
Atter-berg Limits	Liquid Limit	24
	Plasticity Index	7
	Linear Shrinkage	6,0
	PI < 0.075	-
Unified Soil Classification		SM & SC
U.S. Highway Classification		A-2-4 (0)

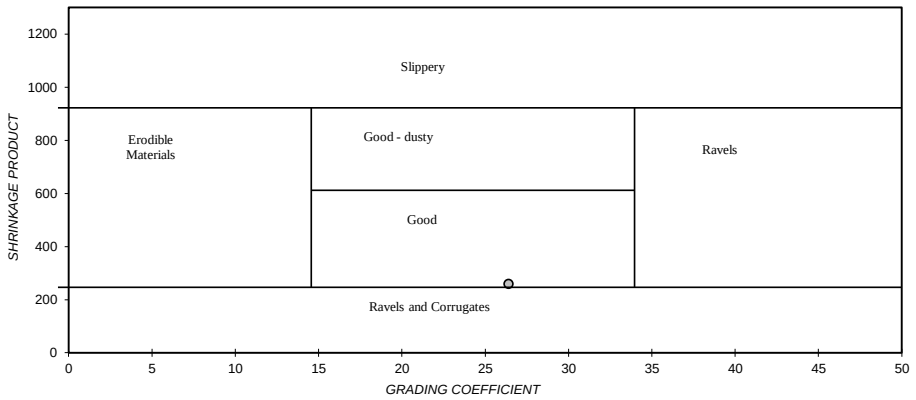
POTENTIAL EXPANSIVENES



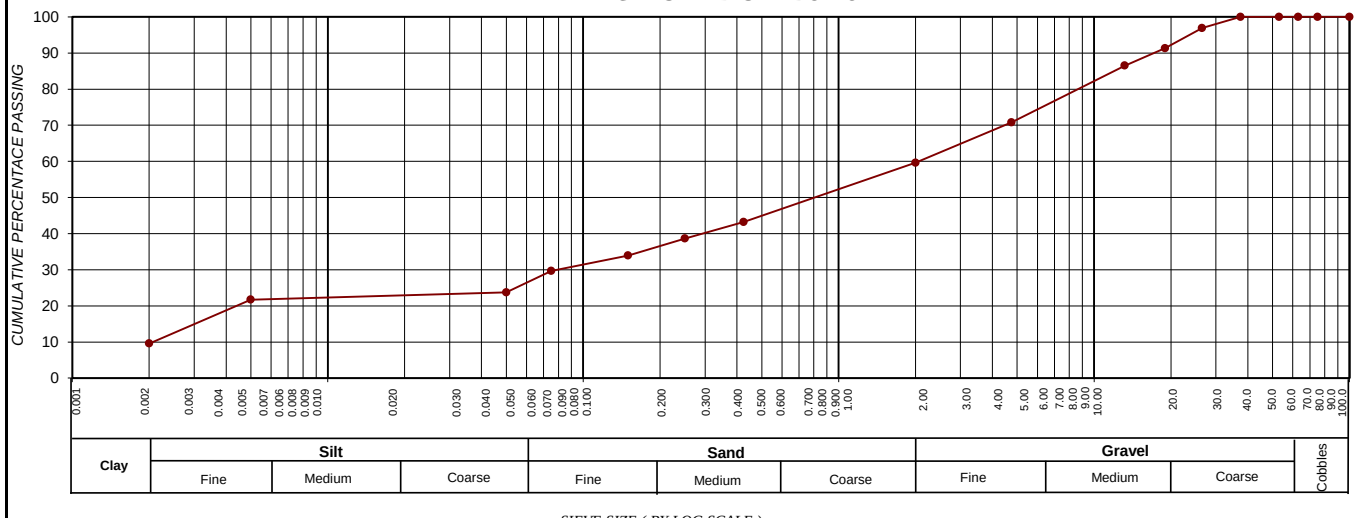
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
9,6	16,3	33,7	40,4

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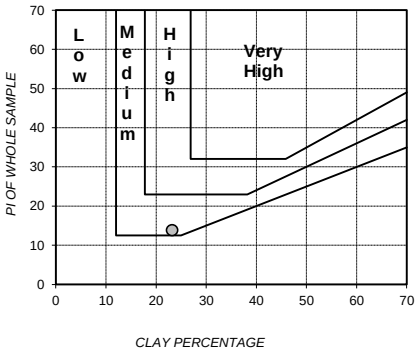
OUR REF : 91454
CLIENT : Johann Van der Merwe
PROJECT : Kaalfontein Hatchery

DATE RECEIVED : 29/10/2018
POSITION : KH/9A
LAYER : 2200-3200mm
SAMPLE No. : 19581
SAMPLE DESCRIPTION : Dark Red Brown Silty Clayey Sandy Gravel

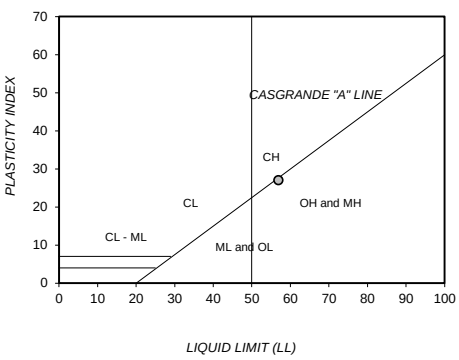
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**13,9**
Sieve analysis Cumulative percentage passing (mm)	100,0	100
	75,0	100
	63,0	100
	50,0	95
	37,5	86
	28,0	81
	20,0	77
	14,0	74
	5,00	69
	2,000	63
	0,425	51
	0,250	50
	0,150	48
	0,075	47
	50 µm	28
	5 µm	26
	2 µm	23,2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	18
	0.425 - 0.250	2
	0.250 - 0.150	3
	0.150 - 0.075	2
	< 0.075	75
Effective size		0,056
Uniformity Coefficient		32,7
Curvature Coefficient		1,1
Oversize Index		14,2
Shrinkage Product		718,2
Grading Coefficient		12,6
Grading modulus		1,39
Atter-berg Limits	Liquid Limit	57
	Plasticity Index	27
	Linear Shrinkage	14,0
	PI < 0.075	-
Unified Soil Classification		MH
U.S. Highway Classification		A-7-5 (9)

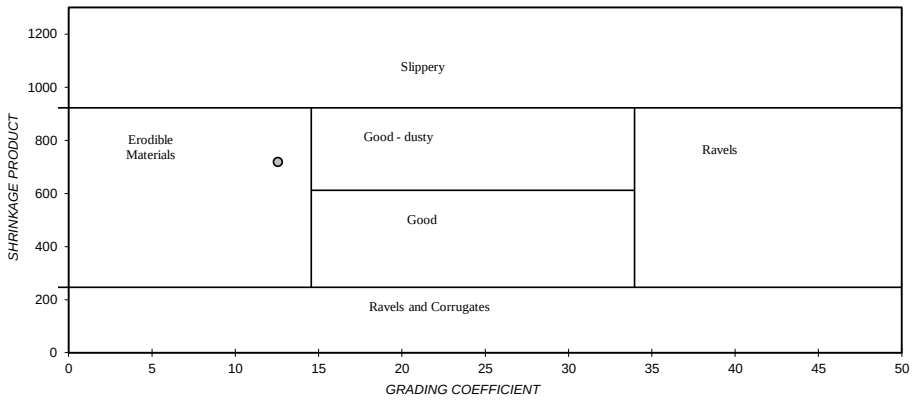
POTENTIAL EXPANSIVENES



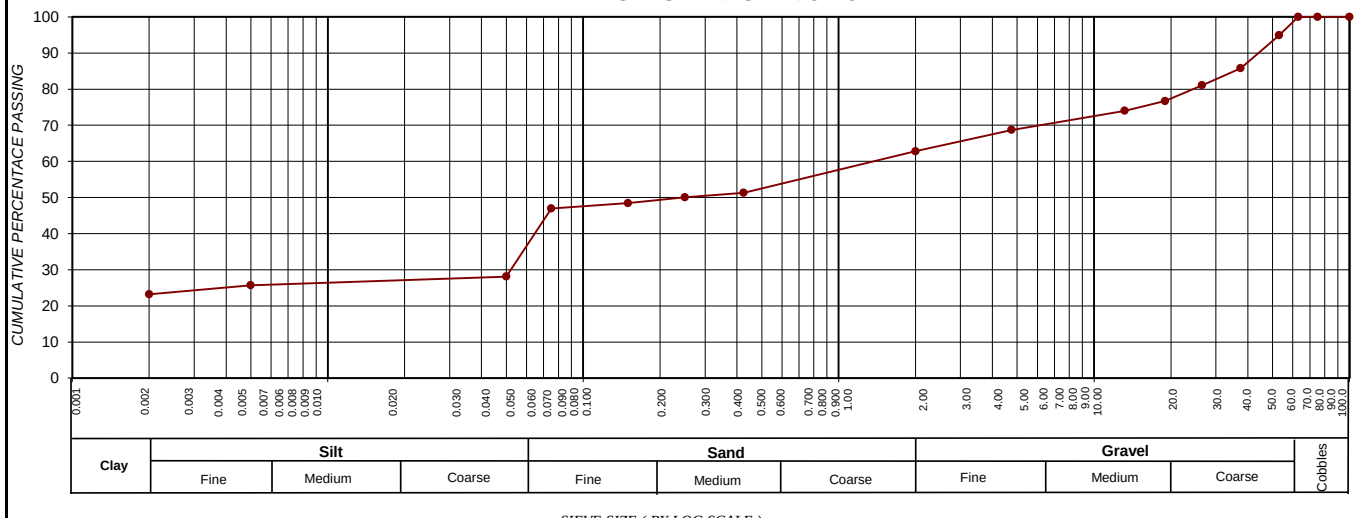
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
23,2	11,1	28,5	37,2

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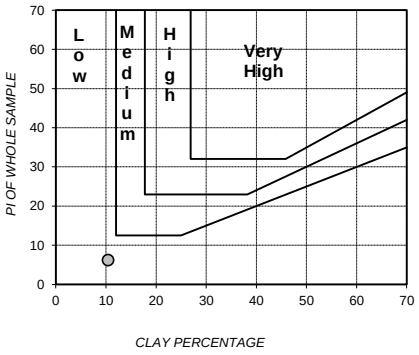
OUR REF : 91454
CLIENT : Johann Van der Merwe
PROJECT : Kaalfontein Hatchery

DATE RECEIVED : 29/10/2018
POSITION : KH/10
LAYER : 1600-2500mm
SAMPLE No. : 19484
SAMPLE DESCRIPTION : Dark Red Brown Clayey Silty Sandy Gravel

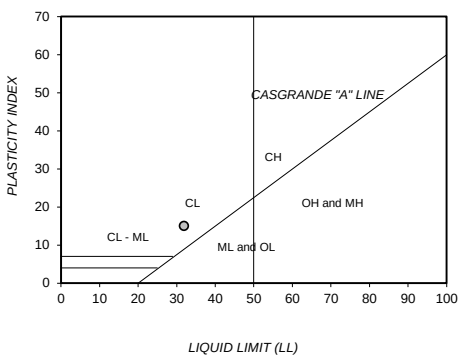
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**6,2**
Sieve analysis Cumulative percentage passing (mm)	100,0	100
	75,0	100
	63,0	100
	50,0	97
	37,5	97
	28,0	96
	20,0	93
	14,0	91
	5,00	75
	2,000	57
	0,425	42
	0,250	37
	0,150	33
	0,075	29
	50 µm	21
	5 µm	15
	2 µm	10,4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	28
	0.425 - 0.250	8
	0.250 - 0.150	8
	0.150 - 0.075	6
	< 0.075	51
Effective size		0,056
Uniformity Coefficient		32,7
Curvature Coefficient		1,1
Oversize Index		3,1
Shrinkage Product		332,0
Grading Coefficient		28,7
Grading modulus		1,72
Atter-berg Limits	Liquid Limit	32
	Plasticity Index	15
	Linear Shrinkage	8,0
	PI < 0.075	-
Unified Soil Classification		SC
U.S. Highway Classification		A-2-6 (1)

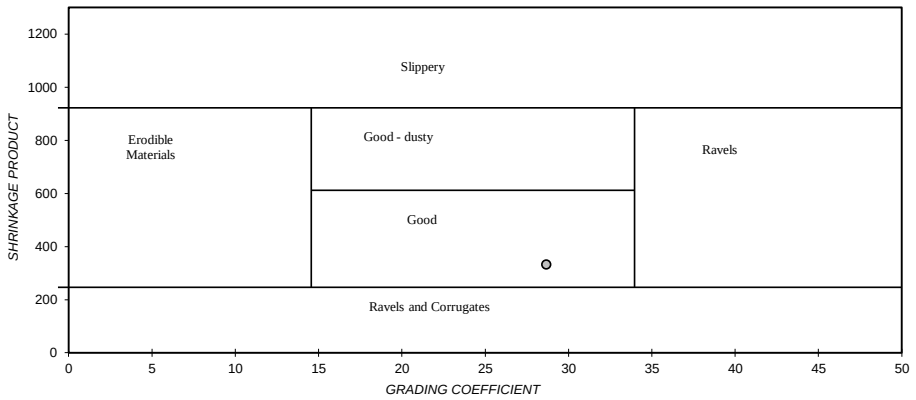
POTENTIAL EXPANSIVENES



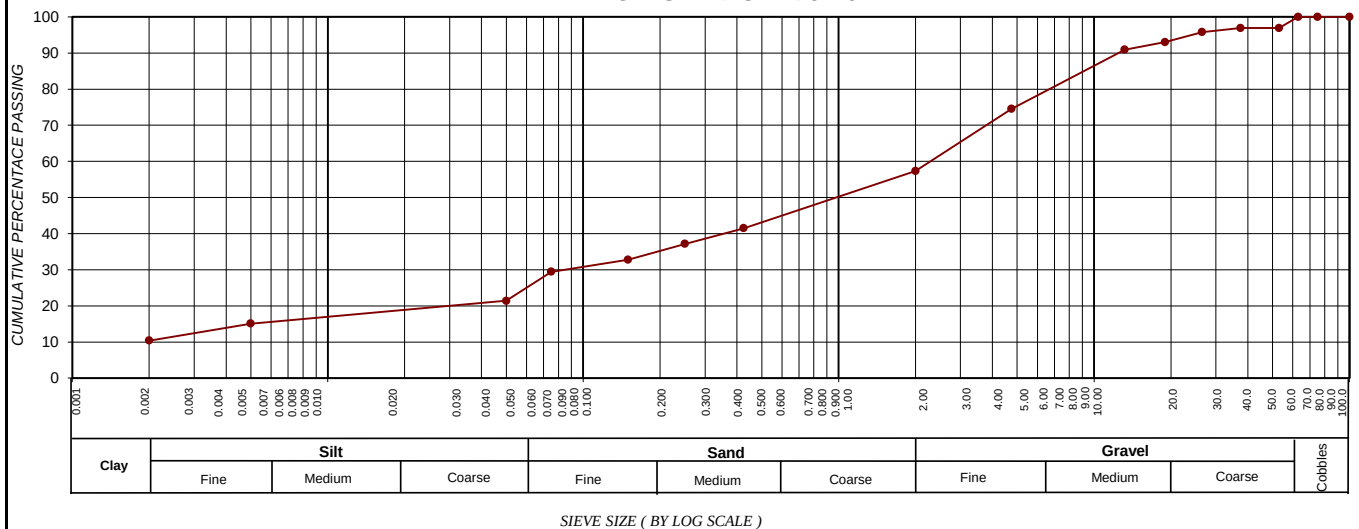
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
10,4	13,4	33,5	42,7

ROADLAB Laboratories
(PTY) LTD . M2011/005423/07 . VAT 4670261090
Civil Engineering Materials Testing Laboratory
Established 2011

CENTURION BRANCH
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121 Ellman Street
Sunderland Ridge
Pretoria
Centurion
0157
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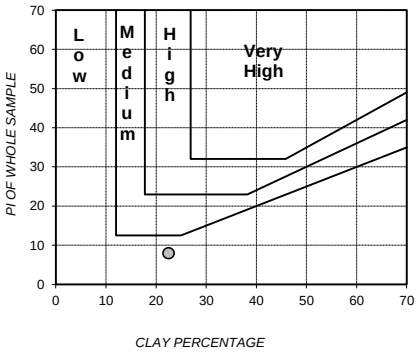
OUR REF : 91454
CLIENT : Johann Van der Merwe
PROJECT : Kaalfontein Hatchery

DATE RECEIVED : 29/10/2018
POSITION : KH/12
LAYER : 800mm
SAMPLE No. : 19662
SAMPLE DESCRIPTION : Dark Red Brown Silty Clayey Sand

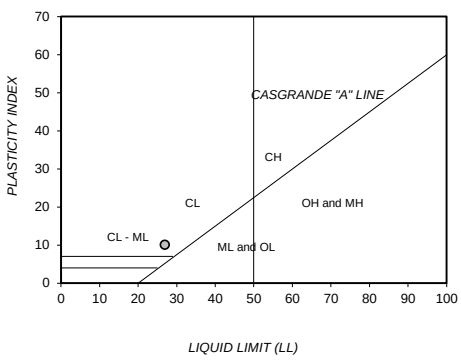
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**8,0**
Sieve analysis Cumulative percentage passing (mm)	100,0	100
	75,0	100
	63,0	100
	50,0	100
	37,5	100
	28,0	100
	20,0	100
	14,0	100
	5,00	100
	2,000	99
	0,425	80
	0,250	62
	0,150	49
	0,075	41
	50 µm	40
	5 µm	29
	2 µm	22,5
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	20
	0.425 - 0.250	18
	0.250 - 0.150	13
	0.150 - 0.075	8
	< 0.075	42
Effective size		0,056
Uniformity Coefficient		32,7
Curvature Coefficient		1,1
Oversize Index		0,0
Shrinkage Product		477,6
Grading Coefficient		1,1
Grading modulus		0,81
Atter-berg Limits	Liquid Limit	27
	Plasticity Index	10
	Linear Shrinkage	6,0
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-4 (1)

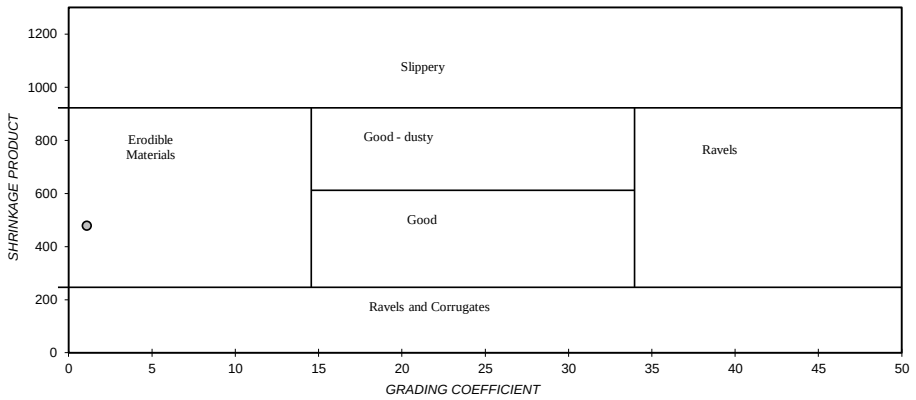
POTENTIAL EXPANSIVENES



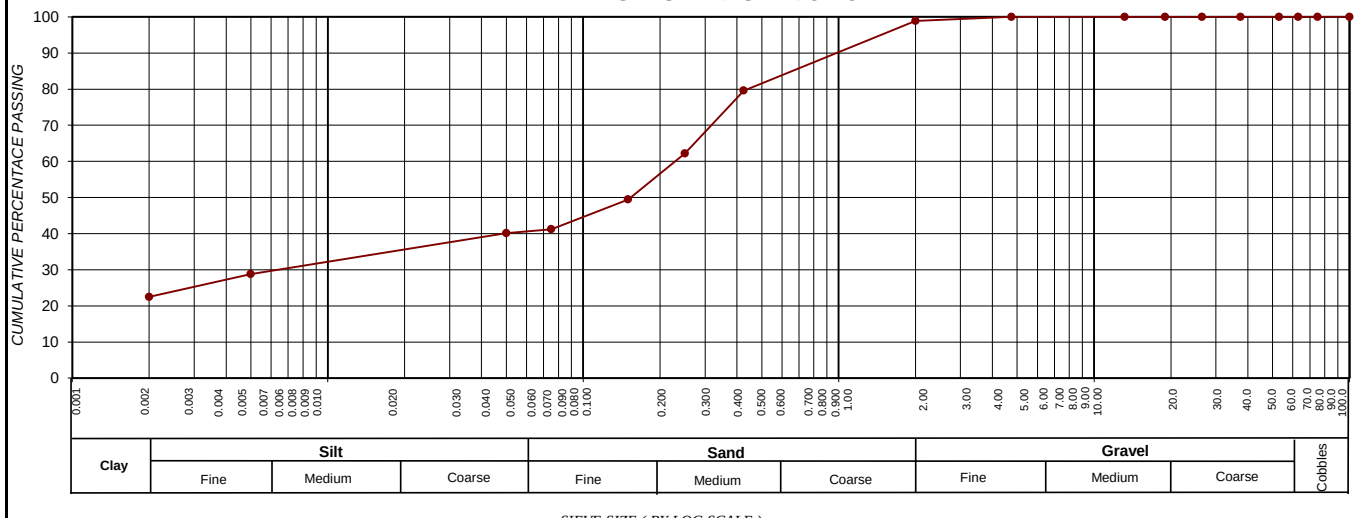
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
22,5	17,4	59,0	1,1

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OUR REF : 91454 **DATE RECEIVED:** 29/10/2018

CLIENT : Johann Van Der Merwe

PROJECT : Kaalfontein Hatchery

ATTENTION: Client

pH & CONDUCTIVITY TEST RESULTS (TMH 1 A20 & A21T)

Sample Number	Layer / Road	Temperature (°C) : Conductivity	Conductivity ($S.m^{-1}$)	Temperature (°C) : pH	pH Value
19661	KH1(1000)	28,9	0,0009	29,1	5,6
19578	KH3(1300-3500)	19,1	0,0228	18,9	6,7
19579	KH6(0-1000)	18,4	0,0012	18,5	5,4
19580	KH6(1000-2000)	18,1	0,0232	18,1	5,9
19581	KH7(2200-3200)	18,1	0,0012	18,1	5,3
19582	KH8(1000-1200)	18,1	0,0348	18,0	6,8
19583	KH8(1200-2400)	18,1	0,0116	18,1	7,8
19584	KH10(1600-2500)	17,5	0,0012	17,4	6,0
19662	KH12(800)	29,0	0,0092	29,3	5,4

Remarks :

The samples were subjected to analysis according to TMH 1
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab

Collapse Potential

Project:	5688
Client:	Roadlab
Geolab Job Nr:	G18-267
Test Method:	TMH 6 ST10

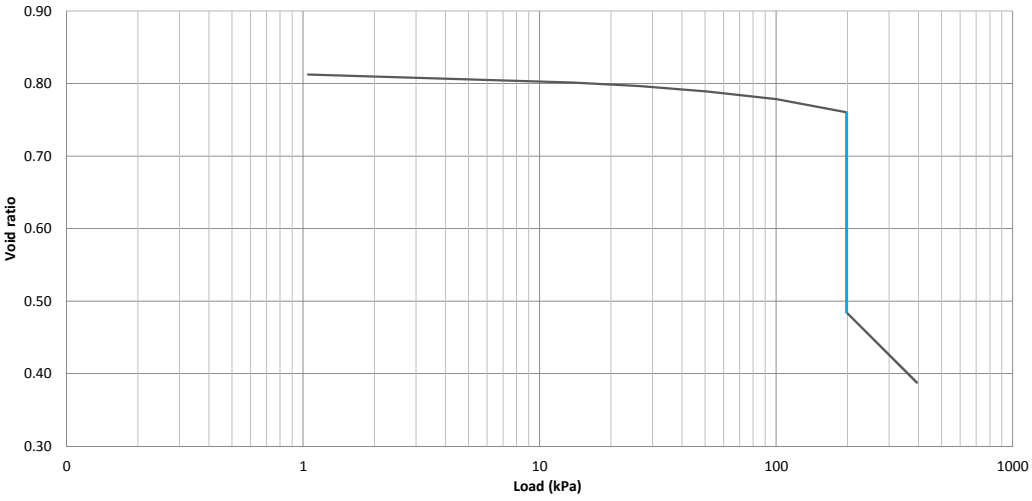
Sample Nr:	KH/12
Sample Depth:	0.8m
Date:	2018-11-06

Results		
Collapse Potential:	14.4	%

Sampling Method:	Block
Disturbed/Undist:	Undisturbed
Remoulded To:	NA

Load kPa	Height mm	Void Ratio
1.1	18.36	0.812
13.7	18.25	0.802
26.4	18.2	0.797
51.2	18.124	0.789
100.7	18.018	0.779
198.4	17.832	0.760
198.4	15.039	0.485
393.3	14.056	0.388

	Initial	Final	
Sample Height:	18.36	14.06	mm
Sample Mass:	56.7	65.6	g
Dry Density:	1538	2009	kg/m³
Density	1566	2366	kg/m³
Moisture Content:	1.8	17.8	%
Void Ratio:	0.812	0.388	
Specific Gravity:	2.788		Mg/m³



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Collapse Potential

Project:	5688
Client:	Roadlab
Geolab Job Nr:	G18-267
Test Method:	TMH 6 ST10

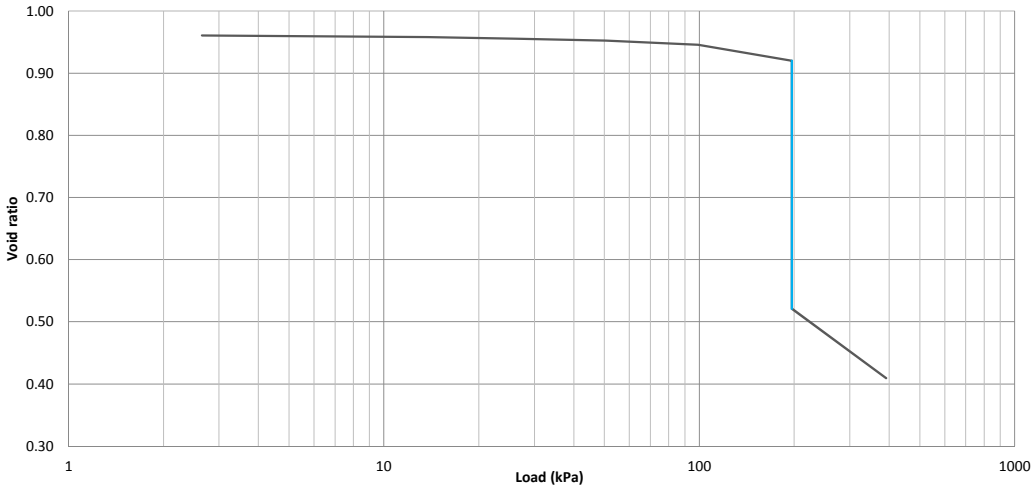
Sample Nr:	KH/1
Sample Depth:	1.0m
Date:	2018-11-06

Results	
Collapse Potential:	19.4 %

Sampling Method:	Block
Disturbed/Undist:	Undisturbed
Remoulded To:	NA

Load kPa	Height mm	Void Ratio
2.7	18.39	0.961
13.7	18.364	0.958
26.0	18.341	0.955
50.5	18.313	0.952
99.2	18.249	0.946
196.6	18.009	0.920
196.6	14.264	0.521
391.0	13.219	0.409

	Initial	Final	
Sample Height:	18.39	13.22	mm
Sample Mass:	52.9	61.5	g
Dry Density:	1428	1987	kg/m³
Density	1460	2364	kg/m³
Moisture Content:	2.2	19.0	%
Void Ratio:	0.961	0.409	
Specific Gravity:	2.801		Mg/m³



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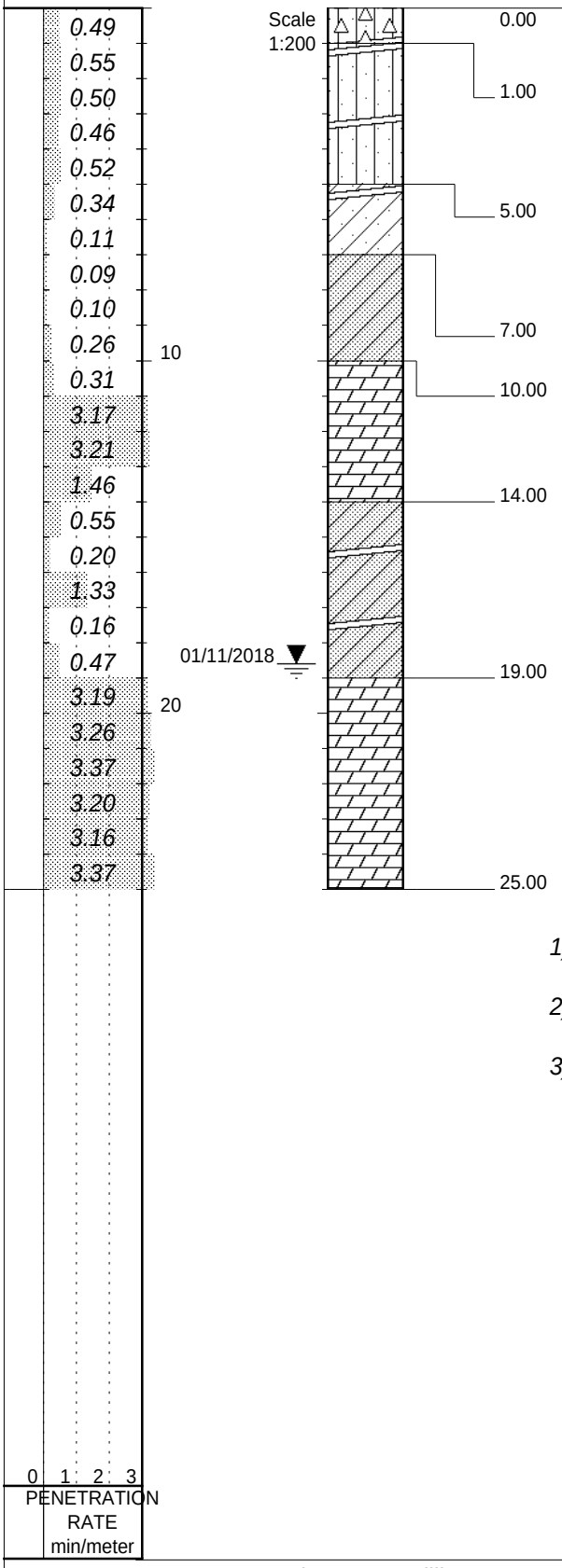
SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: ***KHB/1***
Sheet 1 of 1

JOB NUMBER: *J13/3762*



Light grey, soft rock CHERT BANDS in a matrix of dark red, sandy SILT; colluvium.

Moist, dark red, sandy SILT containing intercalated, dark grey CHERT BANDS; chert residuum.
Overall consistency is dense.

Moist, yellowish brown, sandy CLAY containing abundant coarse CHERT BANDS; chert residuum.
Overall consistency is loose.

Moist, dark grey to black, soft, CLAY WAD; dolomite residuum.

Dark grey banded light grey, moderately weathered, soft rock becoming hard rock DOLOMITE.

No samples recovered. Interpreted as CLAY WAD with CHERT BANDS, based on penetration times.

No samples recovered. Interpreted as hard rock DOLOMITE, based on penetration times.

NOTES

1) *Total air and material loss from below 14m.*
2) *No ground water seepage encountered.*
3) *Water table standing at 18,6m on 01/11/2018.*

CONTRACTOR : *Hennie Erwee Drilling*
MACHINE : *18 Bar*
DRILLED BY :
PROFILED BY : *jovdm*
TYPE SET BY :
SETUP FILE : BH1PG-A4.SET

INCLINATION : *Vertical*
DIAM : *165mm*
DATE : *30/10/2018*
DATE : *30/10/2018*
DATE : 14/11/2018 08:04
TEXT : ..otplot\ARCHIVE\3762a.txt

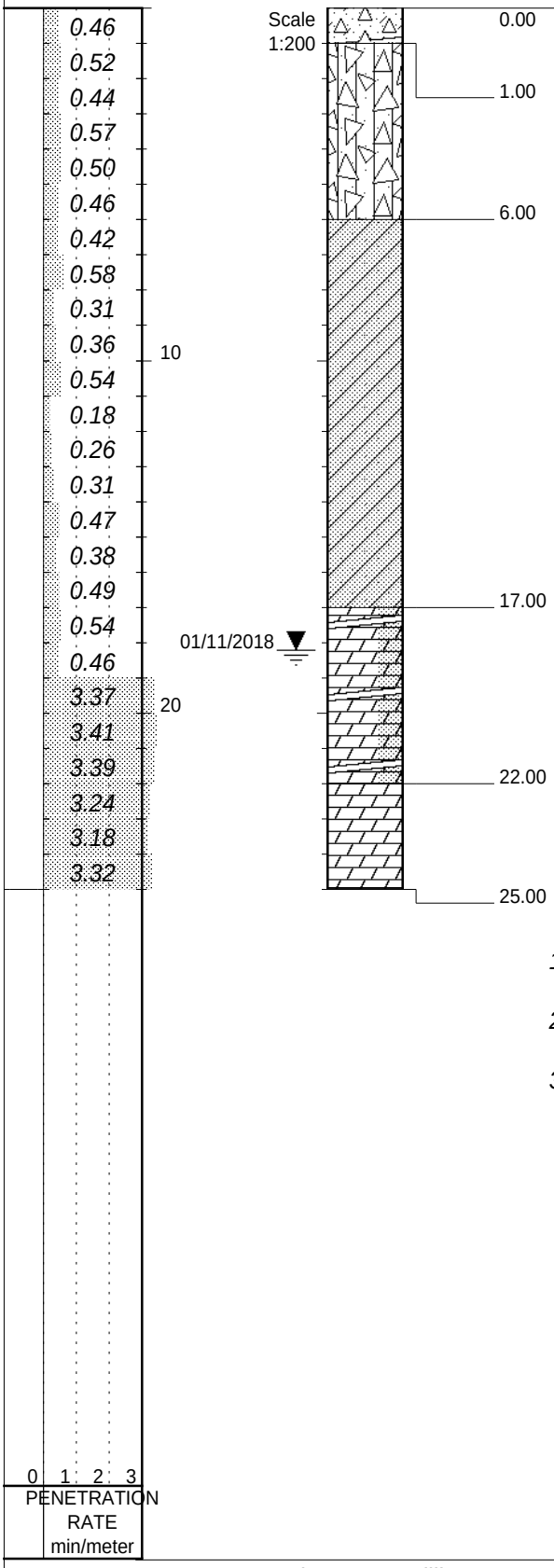
ELEVATION :
X-COORD : *S26 01 34.2*
Y-COORD : *E28 17 20.9*

HOLE No: ***KHB/1***

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KHB/2*
Sheet 1 of 1

JOB NUMBER: *J13/3762*



0.00 — *Moist, dark red, dense, clayey SAND containing coarse CHERT BANDS; colluvium.*

1.00 — *Abundant (50%) medium and fine, grey CHERT FRAGMENTS clast supported in a matrix of moist, dark red, sandy SILT; chert residuum.*

6.00 — *Moist, dark chocolate brown, stiff, sandy CLAY WAD containing scattered fine GRAVELS; dolomite residuum.*

17.00 — *Dark grey, hard rock DOLOMITE with intercalated CHERT BANDS containing infill of WAD on joints.*

22.00 — *Dark grey banded light grey blotched white, unweathered, hard rock DOLOMITE containing intercalated, olive grey, translucent CHERT BANDS.*

25.00

NOTES

1) *No ground water seepage encountered.*

2) *No air or sample loss encountered.*

3) *Water table standing at 18,2m on 01/11/2018.*

CONTRACTOR : *Hennie Erwee Drilling*
MACHINE : *18 Bar*
DRILLED BY :
PROFILED BY : *jovdm*
TYPE SET BY :
SETUP FILE : BH1PG-A4.SET

INCLINATION :
DIAM : *165mm*
DATE : *30/10/2018*
DATE : *30/10/2018*
DATE : 14/11/2018 08:04
TEXT : ..otplot\ARCHIVE\3762a.txt

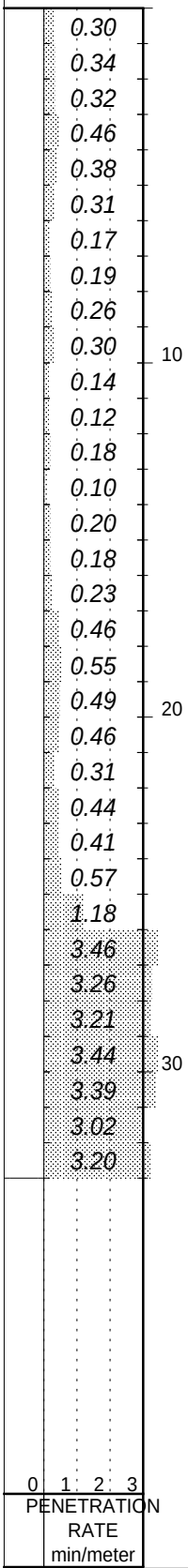
ELEVATION :
X-COORD : *S26 01 35.9*
Y-COORD : *E28 17 20.7*

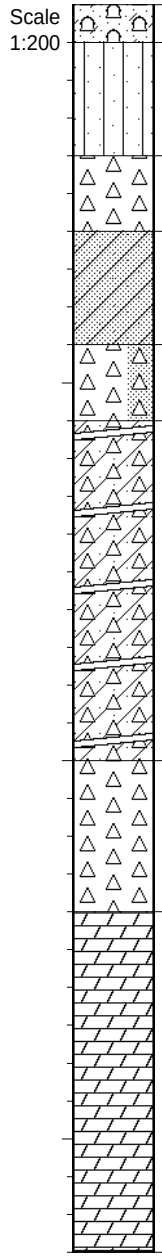
HOLE No: *KHB/2*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KHB/3*
Sheet 1 of 1

JOB NUMBER: *J13/3762*





Abundant coarse, light grey CHERT FRAGMENTS in a matrix of dark brown, clayey SAND; chert residuum.

Moist, dark red, firm, sandy SILT containing scattered fine GRAVELS; chert residuum.

Dark grey blotched yellow, soft rock CHERT containing infill of moist, dark red, clayey SILT.

Moist, dark chocolate brown blotched orange, very stiff, sandy CLAY WAD; dolomite residuum.

Dark grey stained red on joints, moderately weathered, soft rock CHERT containing infill of moist, dark brown, sandy CLAY.

Dark grey banded light grey, soft rock CHERT BANDS alternating with moist, dark chocolate brown, sandy CLAY.

Dark grey banded light grey, slightly weathered, hard rock CHERT.

No samples recovered. Interpreted as hard rock DOLOMITE based on penetration times.

NOTES

1) *No ground water seepage encountered.*
2) *Total material and air loss encountered from 26m to 33m.*
3) *Hole dry on 01/11/2018.*

CONTRACTOR : *Hennie Erwee Drilling*
MACHINE : *18 Bar*
DRILLED BY :
PROFILED BY : *jovdm*
TYPE SET BY :
SETUP FILE : BH1PG-A4.SET

INCLINATION :
DIAM : *165mm*
DATE : *30/10/2018*
DATE : *30/10/2018*
DATE : 14/11/2018 08:04
TEXT : ..otplot\ARCHIVE\3762a.txt

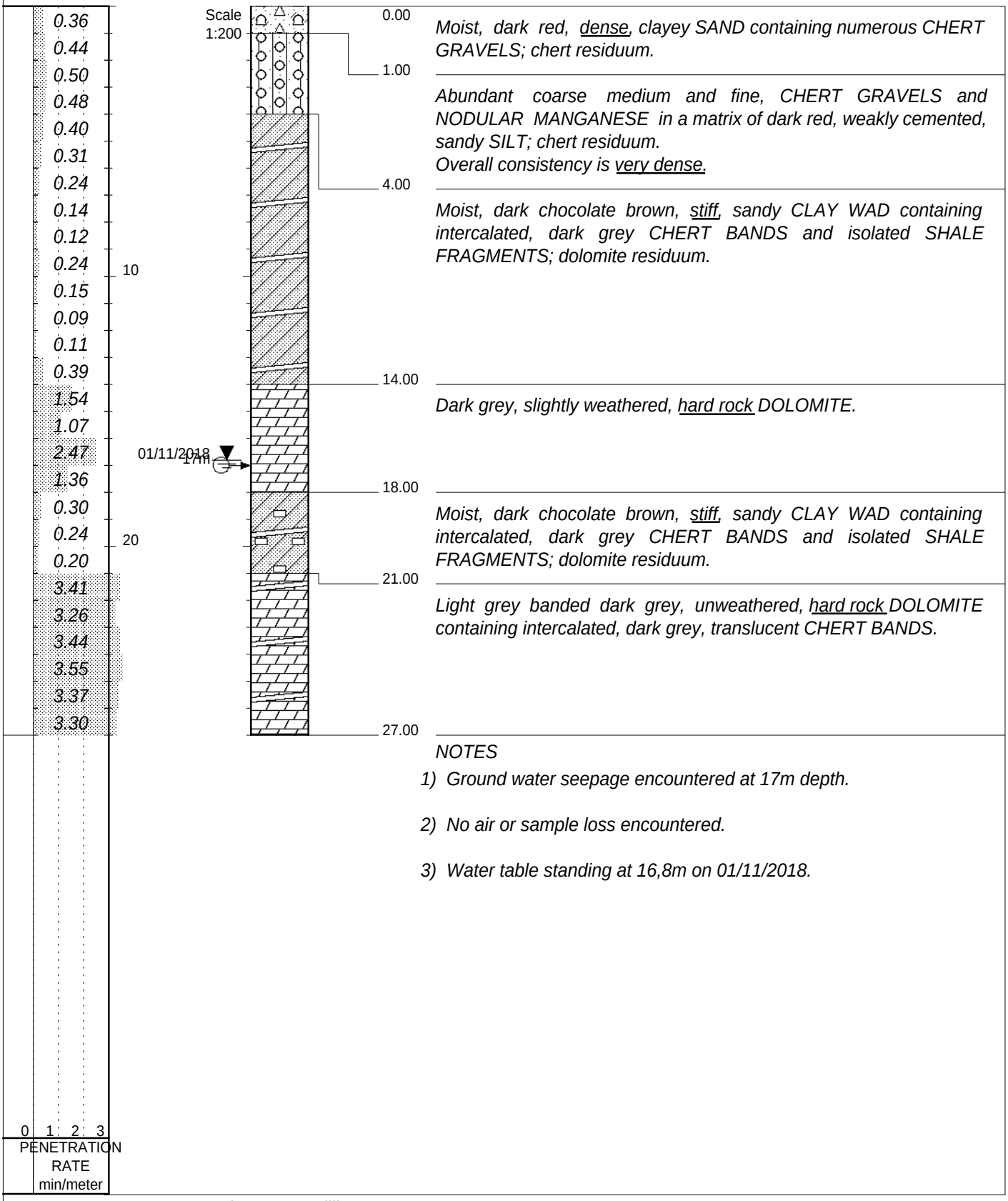
ELEVATION :
X-COORD : *S26 01 39.1*
Y-COORD : *E28 17 20.6*

HOLE No: *KHB/3*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: ***KHB/4***
Sheet 1 of 1

JOB NUMBER: *J13/3762*



Moist, dark red, dense, clayey SAND containing numerous CHERT GRAVELS; chert residuum.

Abundant coarse medium and fine, CHERT GRAVELS and NODULAR MANGANESE in a matrix of dark red, weakly cemented, sandy SILT; chert residuum.
Overall consistency is very dense.

Moist, dark chocolate brown, stiff, sandy CLAY WAD containing intercalated, dark grey CHERT BANDS and isolated SHALE FRAGMENTS; dolomite residuum.

Dark grey, slightly weathered, hard rock DOLOMITE.

Moist, dark chocolate brown, stiff, sandy CLAY WAD containing intercalated, dark grey CHERT BANDS and isolated SHALE FRAGMENTS; dolomite residuum.

Light grey banded dark grey, unweathered, hard rock DOLOMITE containing intercalated, dark grey, translucent CHERT BANDS.

NOTES

1) *Ground water seepage encountered at 17m depth.*
2) *No air or sample loss encountered.*
3) *Water table standing at 16,8m on 01/11/2018.*

CONTRACTOR : *Hennie Erwee Drilling*
MACHINE : *18 Bar*
DRILLED BY :
PROFILED BY : *jovdm*
TYPE SET BY :
SETUP FILE : BH1PG-A4.SET

INCLINATION :
DIAM : *165mm*
DATE : *30/10/2018*
DATE : *30/10/2018*
DATE : 14/11/2018 08:04
TEXT : ..otplot\ARCHIVE\3762a.txt

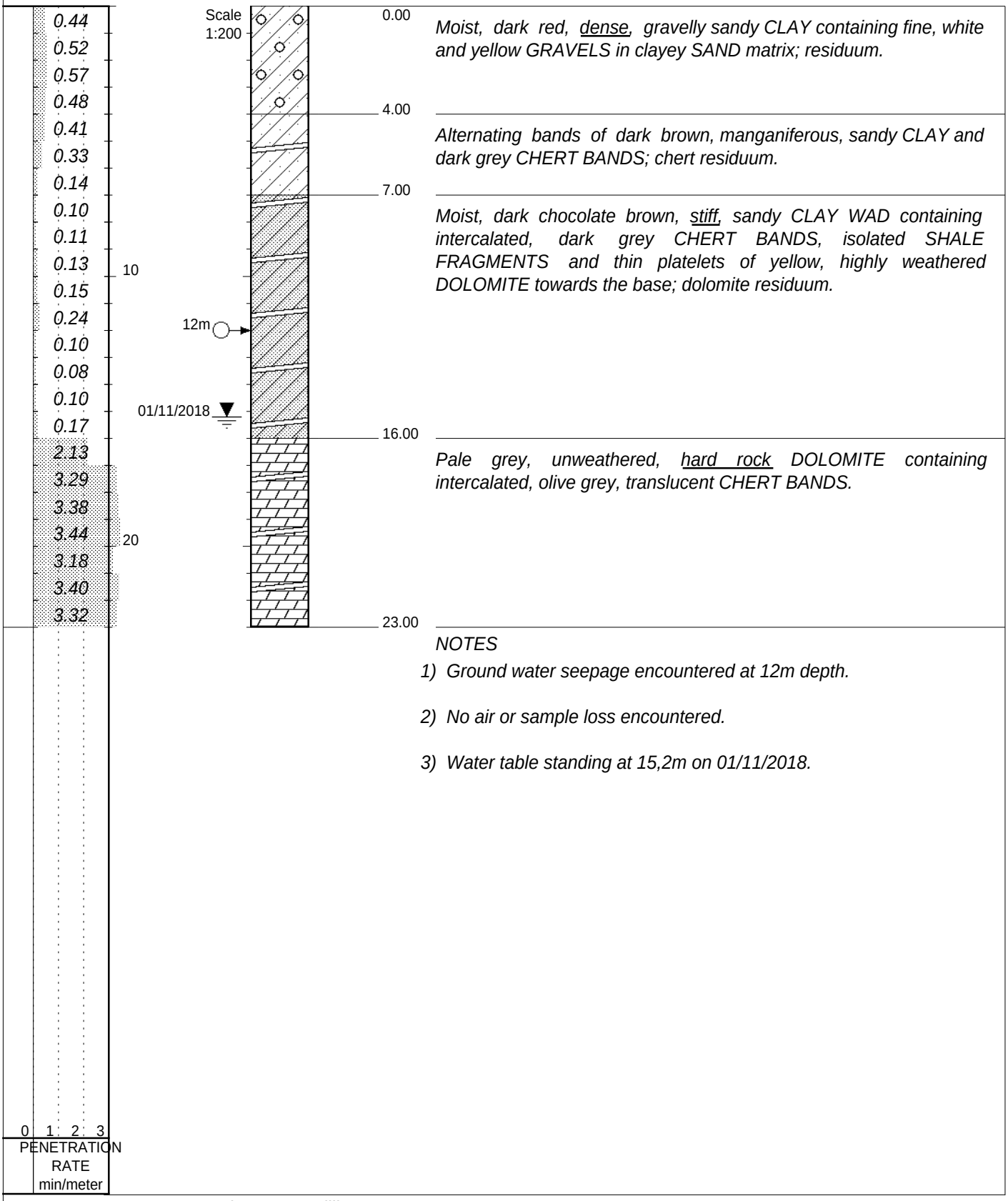
ELEVATION :
X-COORD : *S26 01 38.5*
Y-COORD : *E28 17 24.0*

HOLE No: ***KHB/4***

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KHB/5*
Sheet 1 of 1

JOB NUMBER: *J13/3762*



Moist, dark red, dense, gravelly sandy CLAY containing fine, white and yellow GRAVELS in clayey SAND matrix; residuum.

Alternating bands of dark brown, manganiferous, sandy CLAY and dark grey CHERT BANDS; chert residuum.

Moist, dark chocolate brown, stiff, sandy CLAY WAD containing intercalated, dark grey CHERT BANDS, isolated SHALE FRAGMENTS and thin platelets of yellow, highly weathered DOLOMITE towards the base; dolomite residuum.

Pale grey, unweathered, hard rock DOLOMITE containing intercalated, olive grey, translucent CHERT BANDS.

NOTES

1) *Ground water seepage encountered at 12m depth.*
2) *No air or sample loss encountered.*
3) *Water table standing at 15,2m on 01/11/2018.*

CONTRACTOR : *Hennie Erwee Drilling*
MACHINE : *18 Bar*
DRILLED BY :
PROFILED BY : *jovdm*
TYPE SET BY :
SETUP FILE : BH1PG-A4.SET

INCLINATION :
DIAM : *165mm*
DATE : *30/10/2018*
DATE : *30/10/2018*
DATE : 14/11/2018 08:04
TEXT : ..otplot\ARCHIVE\3762a.txt

ELEVATION :
X-COORD : *S26 01 35.9*
Y-COORD : *E28 17 24.7*

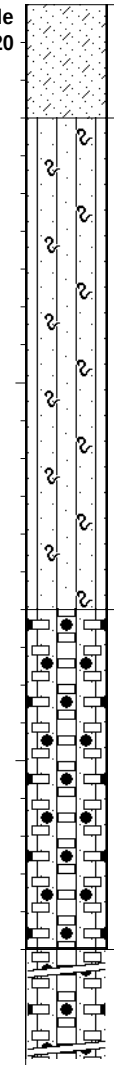
HOLE No: *KHB/5*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/10*
Sheet 1 of 1

JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Dry, reddish dark brown, dense, clayey SAND; colluvium.*

0.30 *Slightly moist, dark red, firm, voided, sandy SILT containing roots; colluvium.*

1.60 *Abundant coarse, white blotched black CHERT GRAVELS and NODULAR MANGANOCRETE, clast supported in a subordimate matrix of weakly cemented, sandy SILT; chert residuum. Overall consistency is very dense.*

2.50 *As above and containing BANDS of soft rock CHERT; chert residuum. Overall consistency is very dense.*

NOTES

1) *Gradual refusal of backactor at 2,5m.*

2) *No water seepage encountered.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*

TYPE SET BY : BC
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*

DATE : 14/11/2018 07:55
TEXT : ..otplot\ARCHIVE\3762B.txt

ELEVATION :
X-COORD : *S26 01 35.9*
Y-COORD : *E28 17 20.5*

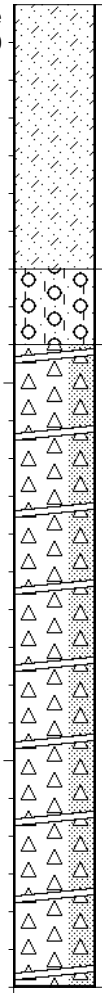
HOLE No: *KH/10*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/11*
Sheet 1 of 1

JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Dry, reddish dark brown, dense, clayey SAND; colluvium.*

0.70 *Dry, dark red, loose, silty sandy GRAVEL; colluvium.*

0.90 *Bands of white stained red, highly weathered, soft rock CHERT alternating with dry, dark red, sandy SILT; chert residuum. Overall consistency is very dense.*

2.60

NOTES

1) *Gradual refusal of backactor at 2,6m in very dense chert residuum.*

2) *No water seepage encountered.*

3) *Material excavates as coarse angular gravels up to 100mm diameter in size.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*

TYPE SET BY : BC
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*

DATE : 14/11/2018 07:55
TEXT : ..otplot\ARCHIVE\3762B.txt

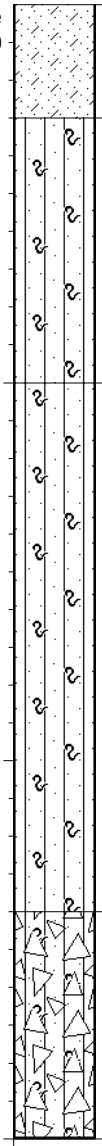
ELEVATION :
X-COORD : *S26 01 34.5*
Y-COORD : *E28 17 20.6*

HOLE No: *KH/11*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/12*
Sheet 1 of 1
JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Dry, reddish dark brown, dense, clayey SAND; colluvium.*

0.30 *Slightly moist, dark red, firm, voided, sandy SILT containing roots; colluvium.*

1.00 *Slightly moist, dark red, soft, voided, sandy SILT containing roots; colluvium.*

2.40 *Abundant coarse, white, highly weathered CHERT FRAGMENTS clast supported in a matrix as above; chert residuum.*
Overall consistency is dense.

3.00

NOTES

1) *No refusal of backactor at 3,0m.*

2) *No water seepage encountered.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*
TYPE SET BY : **BC**
SETUP FILE : **STANDARD.SET**

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*
DATE : **14/11/2018 07:55**
TEXT : **..otplot\ARCHIVE\3762B.txt**

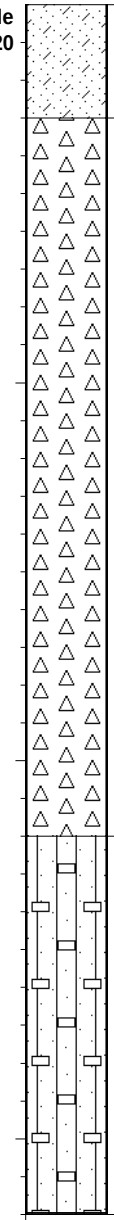
ELEVATION :
X-COORD : *S26 01 33.6*
Y-COORD : *E28 17 20.4*

HOLE No: *KH/12*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/9A*
Sheet 1 of 1
JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Dry, dark reddish brown, dense, intact, clayey SAND; colluvium.*

0.30 *Off white banded red, highly weathered, soft rock CHERT containing infill of dark red, clayey SAND.*

2.20 *Moist, dark reddish brown, firm, slightly voided, sandy SILT containing numerous coarse CHERT FRAGMENTS; chert residuum.*

3.20

NOTES

1) *No refusal of backactor at 3,2m.*
2) *No water seepage encountered.*
3) *Profile description representative of western side of test pit.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*
TYPE SET BY : **BC**
SETUP FILE : **STANDARD.SET**

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*
DATE : **14/11/2018 07:55**
TEXT : **..otplot\ARCHIVE\3762B.txt**

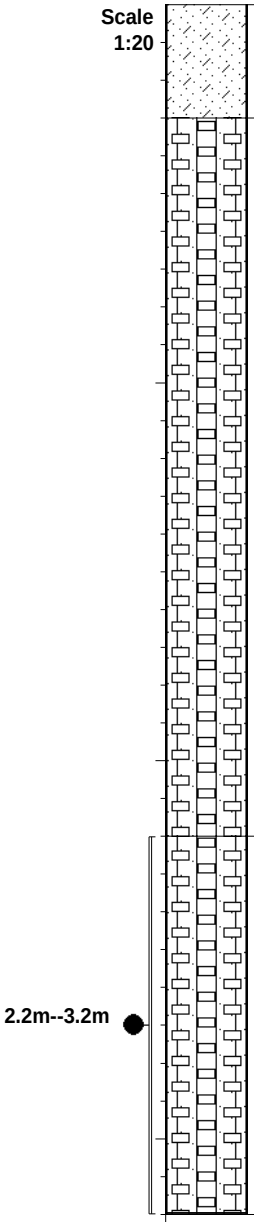
ELEVATION :
X-COORD : *S26 01 38.7*
Y-COORD : *E28 17 19.1*

HOLE No: *KH/9A*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/9B*
Sheet 1 of 1
JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Dry, dark reddish brown, dense, intact, clayey SAND; colluvium.*

0.30 *Abundant coarse medium and fine CHERT FRAGMENTS in a matrix of dark reddish brown, sandy SILT; chert residuum.*
Overall consistency is dense.

2.20 *Moist, dark reddish brown, firm, slightly voided, sandy SILT containing numerous coarse CHERT FRAGMENTS; chert residuum.*

3.20

NOTES

1) *No refusal of backactor at 3,2m.*
2) *No water seepage encountered.*
3) *Disturbed foundation indicator sample taken from 2,2m--3,2m.*
4) *Profile description representative of eastern side of test pit.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*
TYPE SET BY : BC
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*
DATE : 14/11/2018 07:55
TEXT : ..otplot\ARCHIVE\3762B.txt

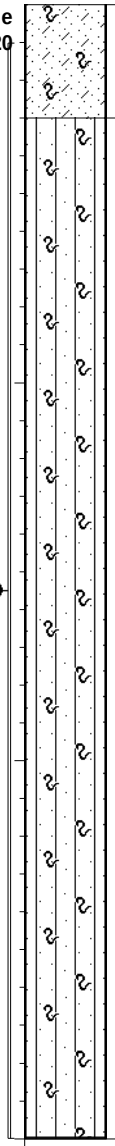
ELEVATION :
X-COORD : *S26 01 38.7*
Y-COORD : *E28 17 19.1*

HOLE No: *KH/9B*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/1*
Sheet 1 of 1
JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Slightly moist to dry, dark brown, dense, voided, clayey SAND containing roots; colluvium.*

0.30 *Slightly moist, reddish brown, firm to stiff, voided, sandy SILT containing roots and isolated CHERT COBBLES; colluvium.*

3.00

NOTES

1) *No refusal of backactor at 3,0m.*
2) *No water seepage encountered.*
3) *Disturbed bulk sample taken from 0,1m--3,0m.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*

INCLINATION : *Vertical*
DIAM : *Trench*
DATE :
DATE : *30/10/2018*

ELEVATION :
X-COORD : *S25 57 28.7*
Y-COORD : *E28 12 28.9*

HOLE No: *KH/1*

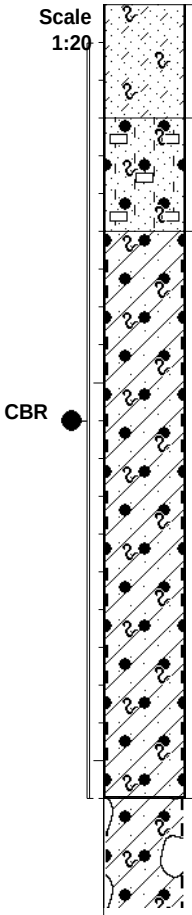
TYPE SET BY : BC
SETUP FILE : STANDARD.SET

DATE : 14/11/2018 07:55
TEXT : ..otplot\ARCHIVE\3762B.txt

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/2*
Sheet 1 of 1
JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Slightly moist to dry, dark brown, medium dense, voided, clayey SAND containing roots; colluvium.*

0.30 *Abundant coarse and medium, sub-rounded and sub-angular, NODULAR MANGANOCRETE and CHERT GRAVELS, clast supported in a matrix of slightly moist, reddish brown, silty SAND and containing fine roots; pebble marker.*
Overall consistency is medium dense.

0.60 *Abundant coarse, NODULAR MANGANOCRETE and CHERT GRAVELS, clast supported in a matrix of partially ferruginised, sandy CLAY and containing fine roots; chert residuum.*
Overall consistency is very dense.

2.10 *As above and containing scattered CHERT COBBLES.*
Overall consistency is very dense.

NOTES

1) *Gradual refusal of backactor at 2,1m.*
2) *No water seepage encountered.*
3) *Disturbed bulk CBR sample taken from 0,1m--2,1m.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*
TYPE SET BY : BC
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*
DATE : 14/11/2018 07:55
TEXT : ..otplot\ARCHIVE\3762B.txt

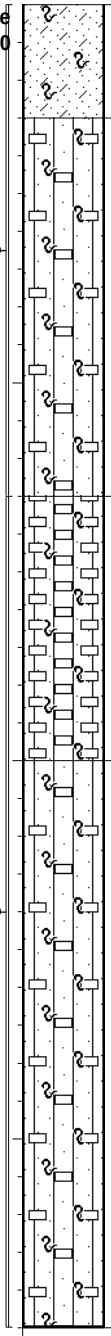
ELEVATION :
X-COORD : *S26 01 32.7*
Y-COORD : *E28 17 22.9*

HOLE No: *KH/2*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/3*
Sheet 1 of 1
JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Slightly moist to dry, dark brown, dense, voided, clayey SAND containing roots; colluvium.*

0.30 *Slightly moist, reddish brown, firm to stiff, slightly voided, sandy SILT containing numerous coarse, medium and fine, sub-rounded and sub-angular CHERT FRAGMENTS and roots; dolomite residuum.*

1.30 *Moist, reddish brown mottled red, stiff, slightly voided, sandy SILT containing scattered angular CHERT FRAGMENTS and roots; dolomite residuum.*

2.00 *Moist to very moist, dark reddish brown mottled black, firm, intact, sandy SILT containing minor to numerous CHERT FRAGMENTS and fine roots; dolomite residuum.*

3.50

NOTES

1) *No refusal of backactor at 3,5m.*
2) *No water seepage encountered.*
3) *Disturbed bulk sample taken from 0,0m--1,3m depth.*
4) *Disturbed foundation indicator sample taken from 1,3m--3,5m.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*
TYPE SET BY : **BC**
SETUP FILE : **STANDARD.SET**

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*
DATE : **14/11/2018 07:55**
TEXT : **..otplot\ARCHIVE\3762B.txt**

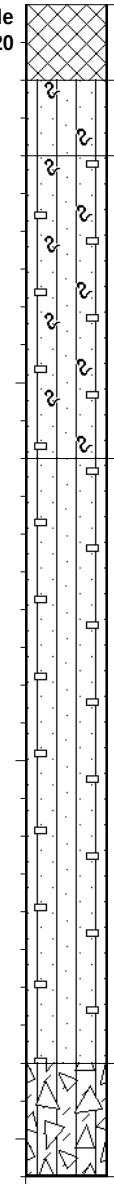
ELEVATION :
X-COORD : *S26 01 35.5*
Y-COORD : *E28 17 24.7*

HOLE No: *KH/3*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/4*
Sheet 1 of 1
JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *FILL; Slightly moist, reddish brown banded yellow, medium dense becoming loose, clayey SAND containing bands of SAND roots.*

0.20 *Moist, reddish brown, firm, voided, sandy SILT containing roots and scattered CHERT GRAVELS; colluvium.*

0.40 *Moist, dark reddish brown, stiff, slightly voided, sandy SILT containing minor, sub-rounded and sub-angular CHERT FRAGMENTS and fine roots; dolomite residuum.*

1.20 *Moist, reddish brown, firm to stiff, slightly voided, sandy SILT containing scattered CHERT FRAGMENTS; dolomite residuum.*

2.80 *Abundant coarse medium and fine, sub-angular and angular CHERT FRAGMENTS clast supported in a matrix of moist, reddish brown blotched dark brown, clayey SILT; dolomite residuum.*
Overall consistency is medium dense.

3.10

NOTES

1) *No refusal of backactor at 3,1m.*

2) *No water seepage encountered.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*

TYPE SET BY : BC
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*

DATE : 14/11/2018 07:55
TEXT : ..otplot\ARCHIVE\3762B.txt

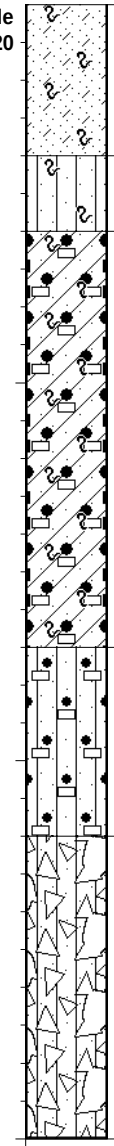
ELEVATION :
X-COORD : *S26 01 36.2*
Y-COORD : *E28 17 24.6*

HOLE No: *KH/4*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/5*
Sheet 1 of 1
JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Slightly moist to dry, dark brown, dense, voided, clayey SAND containing roots; colluvium.*

0.40 *Slightly moist, reddish brown, firm, voided, sandy SILT containing roots and isolated CHERT COBBLES; colluvium.*

0.60 *Abundant coarse, NODULAR MANGANOCRETE and CHERT GRAVELS clast supported in a matrix of partially ferruginised, sandy CLAY and containing fine roots; dolomite residuum.*
Overall consistency is very dense.

1.70 *Moist, reddish brown, firm to stiff, slightly voided, sandy SILT containing numerous CHERT GRAVELS and NODULAR MANGANOCRETE; dolomite residuum.*

2.20 *Abundant coarse, medium and fine, sub-rounded and sub-angular CHERT GRAVELS and COBBLES in a matrix of moist, reddish brown, sandy SILT; dolomite residuum.*
Overall consistency is dense.

3.00

NOTES

1) *No refusal of backactor at 3,0m.*

2) *No water seepage encountered.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*

TYPE SET BY : BC
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*

DATE : 14/11/2018 07:55
TEXT : ..otplot\ARCHIVE\3762B.txt

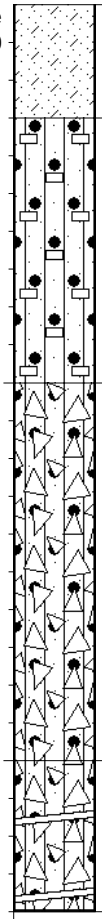
ELEVATION :
X-COORD : *S26 01 37.8*
Y-COORD : *E28 17 24.9*

HOLE No: *KH/5*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/6*
Sheet 1 of 1
JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Dry, dark red, dense, clayey SAND; colluvium.*

0.30 *Abundant coarse GRAVELS and COBBLES of black blotched yellow, cemented NODULAR MANGANOCRETE, clast supported in a subordinate matrix of slightly moist, dark red, sandy SILT; manganizised residuum.*
Overall consistency is loose.

1.00 *Abundant coarse NODULAR MANGANOCRETE and bluish-grey CHERT FRAGMENTS, clast supported in a s/o matrix of weakly cemented, dark red, sandy SILT; chert residuum.*
Overall consistency is very dense.

2.00 *As above and containing bands of dark grey stained yellow, soft rock CHERT.*
Overall consistency is very dense.

2.40

NOTES

1) *Gradual refusal of backactor in very dense chert residuum at 2,4m.*

2) *No water seepage encountered.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*

ELEVATION :
X-COORD : *S26 01 38.5*
Y-COORD : *E28 17 22.3*

HOLE No: *KH/6*

TYPE SET BY : BC
SETUP FILE : STANDARD.SET

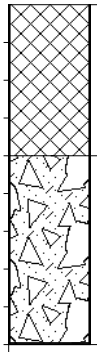
DATE : 14/11/2018 07:55
TEXT : ..otplot\ARCHIVE\3762B.txt

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/7*
Sheet 1 of 1

JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *FILL: Abundant coarse medium and fine, sub-angular and sub-rounded CHERT GRAVELS in a matrix of slightly moist, reddish brown banded light grey, silty SAND and containing roots.*
Overall consistency is loose.

0.40 *Abundant coarse, medium and fine, sub-angular CHERT GRAVELS and COBBLES, clast supported in a matrix of slightly moist, brown, clayey SAND; chert residuum.*
Overall consistency is very dense.

0.90

NOTES

1) *Gradual refusal of backactor at 0,9m in very dense chert residuum.*

2) *No water seepage encountered.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*

TYPE SET BY : BC
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*

DATE : 14/11/2018 07:55
TEXT : ..otplot\ARCHIVE\3762B.txt

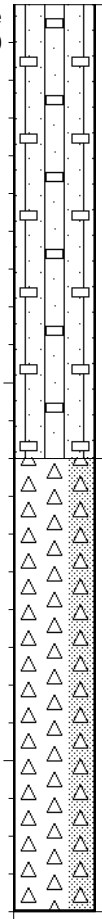
ELEVATION :
X-COORD : *S26 01 39.1*
Y-COORD : *E28 17 21.2*

HOLE No: *KH/7*

SIVEST CONSULTING ENGINEERS
Remainder of Portion 7 of Hartebeestfontein 17-IR, Gauteng Province
DOLOMITE STABILITY GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED EXTENSIONS TO KAALFONTEIN HATCHERY

HOLE No: *KH/8*
Sheet 1 of 1
JOB NUMBER: *J13/3762*

Scale 1:20



0.00 *Moist, dark red, very stiff, sandy SILT containing abundant coarse CHERT GRAVELS; colluvium.*

1.20 *Dark bluish grey banded light grey, closely fractured, soft rock CHERT containing infill of dark red, sandy SILT.*

2.40

NOTES

1) *Gradual refusal of backactor at 2,4m in chert bedrock.*

2) *No water seepage encountered.*

CONTRACTOR : *Richard Irons Plant Rentals*
MACHINE : *JCB 3CX Eco Backactor*
DRILLED BY :
PROFILED BY : *AVDM/JOVDM*
TYPE SET BY : BC
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : *Trench*
DATE :
DATE : *30/10/2018*
DATE : 14/11/2018 07:55
TEXT : ..otplot\ARCHIVE\3762B.txt

ELEVATION :
X-COORD : *S26 01 37.3*
Y-COORD : *E28 17 21.0*

HOLE No: *KH/8*

PRECAUTIONARY MEASURES

The general precautionary measures listed in Section 1 below apply to all developments on dolomite land. Specific additional measures with respect to each class of site are given in Section 2. These measures apply in addition to any measures recommended in the Geotechnical Report.

1. GENERAL PRECAUTIONARY MEASURES

1.1 No accumulation of surface water is permitted and the entire development must be properly drained.

1.2 Water-borne sewerage must be installed. French drains are not acceptable.

1.3 All trenches and excavation works must be properly backfilled and compacted according to specifications given in sub-clause 5.7.1 of SABS 1200DB. The backfill material used must be less permeable than the surrounding soil.

1.4 All new ponds, drainage channels and water courses must be rendered impervious by suitable design using, for example concrete or plastic sheeting. Existing watercourses which have not been affected by the development and are not subjected to increased flow may be left in their natural state.

1.5 In order to deal with rain water run off from the roofs of structures. the following is recommended :-

a) If guttering is required by the Local Authority, down pipes should discharge into lined channels. These channels should discharge the water at least 1,5m away from the house from whence it should be able to drain freely away from the house.

b) If no guttering is required, a 1,5m wide apron or sealed surface must be formed around the building such that water discharged from the roof will be distributed and flow freely away from the foundations.

1.6 All stormwater, sewerage and water pipes and channels must be watertight. All drainage and sewerage pipes should be tested for leakage using the air test (see NBRI Info. Sheet X/BOU 2-34) on installation.

1.7 **Chapter II** in "*A Technical Guide to Good House Construction*" NBRI of the CSIR (July 1984) should be consulted concerning the potential corrosion of pipes.

1.8 Water pipes entering buildings should be fitted either with flexible couplings or kinked with a "Z" to allow opportunity for relative movement.

1.9 Water supply pipes should preferably be HDPE pipes (or similar approved) joined using compression-type fittings. UPVC drainage pipes should be joined using fittings with rubber sealing rings. Solvent welding (glueing), thermal welding and screwing of pipes is not recommended due to the limited tolerance of such joints to movement.

1.10 No trees, shrubs or hedges should be planted along the line of water bearing services.

1.11 No boreholes may be sunk without the written approval of the Local Authority. Approval should be subject to an evaluation by an engineering geologist. If the water table is above the bedrock, a blanket ban on exploitation of the ground water should be imposed.

1.12 All roadways must be placed below surrounding ground level to facilitate efficient surface drainage. The elevation of kerbs should not hinder the flow of water onto the road and its discharge into the stormwater drainage system.

2. SPECIAL PRECAUTIONARY MEASURES FOR VARIOUS RISK CLASSES

2.1 Class 1 Land

Class 1 land is characterised as land with a low risk for doline and sinkhole formation.

Class 1 sites may be used for any density and type of residential, light industrial and commercial development provided that appropriate design and precautionary measures are implemented. These sites should preferably be used for residential development and the higher risk sites reserved for commercial/industrial development. Depending on local, engineering geological and environmental constraints, this land can also be considered for grave yards and solid waste disposal sites.

The general precautionary measures listed in **Section 1** apply to Class 1 land.

Class 1 land to be used for site-and-service schemes should preferable have the following characteristics:

i) Karoo material or intrusive draped directly over dolomite.

ii) Substantial thickness of Karoo or intrusive material occurring at shallow depth in relation to overall depth to bedrock.

iii) Dewatering must not be a potential mobilising agency.

iii) Confident prediction of the lateral continuity and distribution of these materials (i.e. lateral boundaries).

A detailed sanitation plan should be drawn up for the development according to the local geological setting and engineering characteristics.

Roads need not necessarily be tarred but should be graded. Longitudinal gradients on unpaved roads must be such that neither excessive erosion nor ponding of water occurs.

Basic access streets should be designed to withstand environmental deterioration such as erosion. Maintenance of drainage is more important than grading unpaved roads.

2.2 Class 2 Land

Class 2 land includes areas where there is a:

- Medium risk of small sinkholes
- Low risk of all other size sinkholes forming
- Low risk of doline formation

Class 2 sites can be used for residential development, including high density low cost housing (affordable housing), commercial or light industrial development.

The general precautionary measures listed in **Section 1** apply to Class 2 land.

Bulk services should be placed either in road reserves or in servitudes with a minimum 5m width. Servitudes may be used either as parks or walkways.

A detailed sanitation plan must be drawn up for the development according to the local geological setting and engineering characteristics. This plan must comply with any requirements of the geotechnical report.

2.3 Class 3 Land

Class 3 land includes areas where there is a:

- medium risk of small and medium size sinkholes forming
- low risk of all other size sinkholes forming
- medium risk of doline formation

Class 3 sites can be considered for selected residential development. High density housing, projects, multi-storey complexes, commercial and light industrial development may be built on Class 3 land provided the engineering design of the foundations will effectively mitigate the risk of damage due to subsidence. Site and service schemes should not be built on Class 3 land.

The general precautionary measures listed in **Section 1** apply to all developments on Class 3 land. Specific additional measures are given below:-

Structures should preferably be founded on lightly reinforced strip footings or slab foundations placed on a compacted soil mattress. The mattress assists in distributing the foundation load preventing water ingress. The mattress must extend at least 2,0m beyond the perimeter of the structure on all sides. Its thickness should be at least 1,5 times the width of the strip footing below founding level or a minimum of 1,0m below slab foundations. Mattresses should be constructed using G7 or better material (SABS 1200M, Table 3b) compacted to 93% mod AASHTO density at optimum moisture content ±2%. Construction of the mattress must be completed prior to the installation of services or excavation of foundation trenches. Water and sewer connections to buildings should be placed within the mattress. If the mattress is penetrated, wet services must be placed in sleeves extending 5m beyond the structure. Backfill to service and foundation trenches must be to the same specification as the remainder of the mattress.

Bulk services must be placed in road reserves or in servitudes of a minimum of 5m width. Servitudes may be used as parks or walkways. If these services are placed in mid-block, a building restriction extending a minimum of 2,5m either side of the pipe must be implemented.

Water and sewer connections to adjacent pairs of units / stands should be placed along the common property boundary. Shared sewer connections should be implemented if this system leads to a reduction in extent of service and minimises disturbance of the environment.

Property and unit entrances should be placed furthest from the trenches of these water and sewer connections.

The sewers on each stand should have a rodding eye or similar in addition to inspection eyes.

Brick and precast concrete walls must be so designed as to provide drainage ports at ground level permitting passage of water.

Additional requirements with respect to multi storey structures, commercial and light industrial development include:

i) Surfaces should be sealed for at least 5m beyond the perimeter of the structure.

ii) Water bearing services should be sleeved where they are within 5m of the structure or where large movements of people occur (e.g. near entrances).

ii) Downpipes from roofs should be discharged either onto sealed surfaces to drain away from structures or into lined drains leading towards roadways / stormwater systems.

2.4 Class 4 Land

Class 4 land includes areas where there is a:

- medium risk for small to large sinkholes
- low risk of very large sinkholes
- medium risk of doline formation in a non-dewatering scenario

Class 4 land can be considered for selected residential development including low density development on stands larger than 1000m^2. High density housing projects may only be considered in conjunction with stringent precautionary measures. These sites may also be used for multi-storey structures, commercial or light industrial development.

The specific precautions recommended in Section 2.3 apply to Class 4 land.

2.5 Class 5 Land

Class 5 land includes areas where there is a:

- high risk of small sinkholes forming
- low risk of larger sinkholes forming
- high risk of doline formation in a non-dewatering scenario

Class 5 sites can be considered for high-rise residential structural, gentlemen's estates, commercial or light industrial development.

The specific precautions recommended in Section 2.3 apply to Class 5 land.

The design of foundations must be undertaken by a suitably qualified Professional Engineer. The design should be tailored to mitigate the particular dolomite stability risks present on the site. Foundation solutions may include the use of compacted soil mattresses but are not limited to this method.

2.6 Class 6 Land

Class 6 land includes areas where there is a:

- high risk of small to medium risk of small sinkholes forming
- low risk of large to very large sinkholes forming
- high risk of doline formation in a non-dewatering scenario

Class 6 sites may be used for gentlemen's estates, commercial or light industrial development.

The specific precautions recommended in Section 2.5 apply to Class 6 land.

RISK MANAGEMENT POLICY

The purpose of this document is to bring the importance of a continuous assessment of the overall stability of the site in terms of the new development by establishing a Risk Management Policy and Strategy for the proposed development and adhering to the recommendations at all times. This Management Policy must take the following into consideration :-

☒ implementation of precautionary measures;
☒ monitor performance and integrity of water bearing services;
☒ maintenance of site in terms of precautionary measures;
☒ emergency procedures if instabilities occur;
☒ rehabilitation of instability
☒ recording events (databank) to ensure no repetition of unaffordable conditions.

i) Precautionary and Remedial Measures

All precautionary measures, as listed in the report, must be adhered where remedial action is recommended, as a precautionary measure, these must be undertaken immediately. Remedial action implies the improvement or remedying of an existing ground condition that may, or may not, exist as a result of poor stormwater management but which has not resulted in sinkhole or doline formation yet, e.g. re-landscaping of an area to promote proper drainage or compaction of soil to render the area less pervious (soil mattresses).

ii) Maintenance

An Infrastructure Maintenance Plan should be drawn up. Such a plan must take cognizance of the measures and procedures set out in the precautionary measure list of the report, e.g. type of piping material to be used and trench backfill specifications.

This plan should also prioritize maintenance tasks according to stability zones. High risk zones should receive absolute priority for the repairing of infrastructure (e.g.. Zone 3). It is important to establish the location of all piping (old- and currently in use). This should be superimposed on the stability zonation to permit the prioritization of maintenance programmes.

All maintenance tasks must be recorded with details such as routine replacement, repair after instability, repair action, time lapsed since problem began, responsible contractor etc. These records must be lodged in a databank, this can be done by the chairperson of the body corporate of the cluster housing development.

Systematic upgrading of degrading services should be undertaken and the Developer should set aside funds for this specific purpose. Working pro-actively, i.e. considering when pipes have to be replaced before an instability is triggered, rather than reactively, will go a long way to ensure overall better stability of a development on dolomite. All excavated trenches should be inspected and profiled to identify potential paleo-sinkholes, which, if identified, must be investigated immediately.

iii) Monitoring

A Monitoring Programme must be designed which sets out acceptable procedures (frequency of various tasks, manner in which it will be undertaken). A responsible person/group must be assigned with the task of co-ordinating this programme. High risk zones should receive absolute priority for inspection and testing (e.g. Zone 3). Monitoring may be done visually, where this practice is deemed sufficient, but must be formalized in writing for record purposes.

Monitoring consists of two parts: monitoring of water-bearing services, roads etc. (infrastructure), top structures and surface monitoring. The latter entails the inspection of the ground surface. Visual inspections are a useful tool in the monitoring of both man-made structures and the ground surface. Surface and structure cracks should be recorded as well as the location of green or moist patches, indicating possible leaks. Ponding of water and problems after rain storms should also be recorded.

In many instances visual inspections may not be sufficient. It may be necessary to undertake precision ground surface leveling. The consultant should advise the Developer on precision leveling, when the necessity for such leveling arises. Regular air and water tests of all services will be essential. In high priority areas testing may be necessary more than once a year. All services must be tested at least once a year and the results recorded.

It is also necessary to consider whether certain new practices may be deemed hazardous and lead to instability if not changed (e.g. the ripping-up of paving to establish flower beds along buildings). During inspections, the responsible group or person should be on the look-out for such unacceptable practices.

iv) Education and vigilance

"Environment awareness" should be fostered among all members of the public living in a dolomitic environment. As part of this campaign, people should understand what impact concentrated surface water may have on the stability of the area. This will lead to better vigilance and the timeous reporting of problems.

v) Emergency Reaction Plan

An emergency procedure must be set out and a responsible person/group should be assigned and trained to respond to emergency situations as a result of sinkhole formation. The person/group must know, for example, where to cut off the water supply if the rupturing of piping caused, or resulted from, the instability. It must be established when evacuation of a building is justified. Funds should be set aside for these eventualities.

vi) Rehabilitation

Rehabilitation, or the repairing of damaged land, may be required for various reasons (e.g. doline formed, borrow pit exists), but has the stabilizing of the affected environment as its common goal. This action should be undertaken as soon as possible to prevent further damage to

the affected area. The maintenance team or a responsible person should know how to rehabilitate a sinkhole. The consultant may advise the relevant groups on how this should be done.

vii) Data Banking

It is important for future use that a databank is set up, which must contain, *inter alia*, the following:

- the dolomite stability and geotechnical report
- old, yet relevant, reports and correspondence
- a layout plan with location of services
- zonation map
- inspection and testing records
- maintenance records (detailing when, how and what was done)
- register of damaged structures
- sinkhole and doline occurrences (with rehabilitation taken)

viii) Reassessment

In order to ensure that the Risk Management Plan is functioning and fully addresses all presently known issues as well as possible future issues, reassessment of the entire Risk Management Plan on a five yearly basis will be essential. This exercise should involve the evaluation of the present Plan in context of the requirements of this document and the report. Note should be made of weaknesses in the Plan as well as additions which may have become evident in the five year period.

As a crucial part of the Risk Management Strategy, attention must be given to the surface drainage on the entire property. All surface water must drain off the structures, directly into lined canals, leading off the property and directly into the regional stormwater system. In order to formalise these principles a Stormwater Management Plan must exist. The plan must also be integrated with a Regional Stormwater Management Plan which pertains to the area outside the boundaries of the site. This plan must form part of a Centralised, Regionalised Risk Management Strategy. All concepts of the development's Risk Management Strategy must be married with those of the Regional Risk Management Strategy.

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Council for Geoscience

Our Reference: F5582.1
Portion 7 of the Farm Hartebeestfontein
Your Reference: M18/3762
Reviewer: J Bunk
Enquiries: S Ngubelanga
Tel: 033 345 6265/6
Email: sngubelanga@geoscience.org.za
No. of pages: 4

30 January 2019

Ekurhuleni Metropolitan Municipality
P O Box 13
Kempton Park
1620

ATTENTION: Pilusa Mashamaite

By Email: *Pilusa.Mashamaite@ekurhuleni.gov.za*

Dear Sir,

PORTION 7 OF THE FARM HARTEBEESFONTEIN

The firm, Johann van der Merwe (Pty) Ltd (JvdM) submitted their report: "Factual Report on Geotechnical Dolomite Stability Investigation carried out for: Proposed additions of Kaalfontein Hatchery on: Remainder of Portion 7 of the Farm Hartebeestfontein 17-IR, Ekhurhuleni Metrolpolitan Municipality, Gauteng Provinceg", dated December 2018 to this office for comment on behalf of their client, Mr H van Niekerk of Sivest Consulting Engineers, on 14 January 2019. This office acts as an agent to state authorities in reviewing dolomite stability investigations on their behalf.

The purpose of the current investigation was to assess the dolomite stability underlying a footprint of the proposed additions to the Kaalfontein Hatchery with respect to the formation of sinkholes and subsidence. The stand is an irregular shaped area of about **24 ha** and is located due north of Kempton Park.

The proposed land use is commercial packaging and storage, **C5** type development in terms of SANS 1936:2012.

The following is noted from the JvdM's report:

1) According to the 1:250 000 Geological Map, Sheet No. 2628 East Rand, the area is underlain by chert-rich dolomite of the Monte Christo Formation of the Malmani Subgroup, Chuniespoort Group of the Transvaal Supergroup.

2) In Section 3 of the report, JvdM indicates that groundwater strikes were recorded between 12 m and 15 m, and water rest levels between 15.2 m and 18.6 m below surface. Groundwater information obtained for the Department of Water Affairs (DWA) indicates that the site lies in the Sterkfontein East Groundwater Compartment with the regional water level at around 1 475 m above sea level which corresponds to the water table on site which is at about 1 572 m. No dewatering is assumed to take place in the vicinity of the study area.

3) A total of five percussion boreholes were used during the current investigation. These boreholes varied in depth between 23 m and 33 m below surface and they generally intersected:
   - Colluvium from surface to 1 m depth.
   - Residual chert and dolomite from surface to 21 m depths.
   - Weathered, soft to hard rock dolomite between 9 m and 33 m depths.

4) Based on the available information, JvdM has classified the site as having an Inherent Hazard Class (IHC) zone, i.e. **IHC 4//4** with a **D3** dolomite area designation.

5) JvdM has made considerations in section 4 of the report to be implemented during the development of this site.

This office would like to comment as follows:

a) This office is not in agreement with the hazard assessment and zonation of the site, footprint area is specified on drawing M18/3762. JvdM has classified the site as **IHC 4//4** with a **D3** dolomite area designation and this is supported.

b) JvdM has indicated that the proposed land use is considered for commercial packaging and storing, **C5** type development. According to Table 2 of SANS 1936-1:2012, **C5** type developments are permissible up to **IHC 5** land, subject to design level investigations and **D3** precautionary measures:
   - This office confirms that the drilling of five boreholes is considered adequate and meets the minimum drilling requirements as stipulated in SANS 1936:2012.
   - This office confirms that the geological conditions as revealed by drilling results are considered to be high risk with respect to the ingress scenario and are generally not suitable for the proposed land use.

c) The considerations in section 4 are generally supported.

Therefore this office confirms support of the proposed additions to the Kaalfontein Hatchery, **C5** type development on Portion 7 of the farm Hartebeestfontein, subject to the points above and the following:

d) A wet services audit survey shall be carried out across the entire site and this shall be reported to the Local Authority. Any shortcomings identified shall be rectified to the satisfaction of the Local Authority and the current SANS 1936:2012 requirements.

e) All foundations should be suitably designed to span at least **5 m** loss of support due to sinkhole or subsidence formation and these must be according to SANS 10400-H requirements.

f) A site specific Dolomite Risk Management Plan in accordance with SANS 1936-4:2012 must be compiled and implemented for the site. The owners/responsible persons must be made aware of the risks involved in building on dolomite, and be informed about how to be vigilant and act pro-actively by applying sound water management principles.

g) General precautionary measures as set out in SANS 1936 Part 3: Design and construction of buildings, structures and infrastructure, must be studied and implemented for a D3 site. Some precautions are listed below:

- All stormwater from downpipes and gutters from buildings and structures shall discharge onto concrete-lined channels which, in turn, shall discharge the water at least 1,5 m away from structures onto areas permitting surface drainage away from buildings and structures. Joints between any open channel drains and buildings shall be suitably sealed.
- Where guttering is not provided, impervious paved areas or apron slabs shall be provided within 3 m (or greater if deemed appropriate by the competent person (engineer)) of buildings or structures, runoff from which shall drain into lined channels feeding into a designed stormwater system or shall be spread as sheet flow. The paved areas or apron slabs shall include areas located below the drip line or the periphery of the building or structure that is subject to draining rainwater.
- Wet engineering services should, wherever possible, not be placed parallel to buildings unless they are at least 5 m away (if stand size allows) from the structure. Should this be unavoidable, a rational design shall be performed by the competent person (engineer).
- Liquid-retaining structures shall be watertight (zero leakage), constructed without any joints, and shall not be placed closer than 5 m from a building. Alternatively, the design of such pools shall be integrated into the rational design of the foundation of the residential structure.
- The preferred pipe type for all wet engineering services, and the sleeve systems for such services, on dolomite area designation D3 sites are polyethylene (PE) pipes and fittings that comply with the material manufacturing requirements of the relevant of parts 1, 2, 3 and 5 of SANS 4427.
- The water supply to a building shall be via a single water supply connection unless otherwise approved by the competent person (engineer). This also applies to other pressurized liquid bearing services.
- Wet engineering services, excluding stormwater systems, shall be capable of spanning the projected notional sinkhole diameter (5 m), which has a high likelihood of formation in accordance with the requirements of SANS 1936-2, without the service rupturing or any joint leaking or separating from the pipeline.
- Gardens within 15 m of buildings and structures shall not include (a) water features, such as fish ponds, except where an impermeable lining is provided in accordance with a design prepared by a competent person (engineer); or (b) water features with automatic replenishment systems. No automated irrigation systems shall be installed

within a distance of 5 m from any structure or building on sites designated as D3 dolomite land.

h) The builder must inform the professional team when the service/foundation trenches are open for inspection to takes place. The results of these inspections and quality control must be recorded in a construction report (copy to the Local Authority and this Office).

i) The professional team involved, including JvdM, shall carefully consider the appropriate water precautionary measures and then ensure and finally certify that these have been implemented.

j) Wet services should be laid exactly where indicated on the drawings presented to the Local Authority, and to this Office. Wet service may not be laid below structures. The Builder or his appointed professional team should certify that they have been placed as indicated. The Home Owner must also have a copy of the exact plan presented to this Office.

k) The Local Authority must implement a risk management system. Commenting on the suitability of sites within its jurisdiction is based on the premise that this system will be implemented.

This letter reflects the view and approach of the Council for Geoscience to development on dolomite at this time, as reflected by the above date. These comments may not be viewed as open-ended. If a property changes ownership or land-use changes are made, the comment may in part or wholly no longer apply. This Office should be informed of such changes and the Competent Person responsible for the dolomite stability investigation should be given the opportunity to indicate the influence such changes could have on the overall stability.

If you have any further queries, please do not hesitate to contact this office.

Yours faithfully,

COUNCIL FOR GEOSCIENCE

S NGUBELANGA
Engineering Geologist

Portion 7 of the Farm Hartebeesfontein (F5582.1)

CC: **Johann van der Merwe (Pty) Ltd**

ATTENTION: Mr. Johann van der Merwe

By email: *jovdm@iafrica.com*